Exploring the Paradox of Sustainable Urban Development: Towards Urban Resilience?

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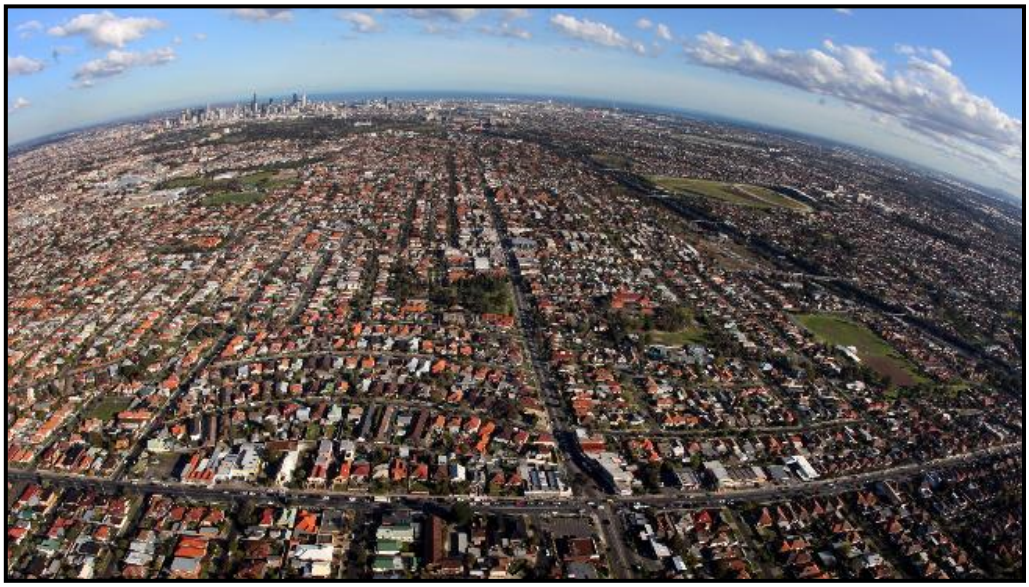

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Abstract

This thesis explores the paradox that urban development continues down a cost minimisation approach resulting in low-density, car-orientated, energy-intensive urban form even though the social and environmental benefits of creating resilient residential communities through the adoption of collective sustainable urban designs and practices are well known. Fundamentally the thesis is concerned with exploring the barriers to creating resilient residential communities in order to establish pathways towards reducing cities' vulnerability to peak oil and impacts on climate change

To achieve this, the urban governance configurations and development practices at three 'innovative' residential development sites were investigated to understand the barriers to constructing sustainable residential communities. The first site was Wigram Skies, Christchurch, New Zealand which is being produced by an indigenous development corporation, Ngai tahu Property. The second is Kirimoko, Wanaka, New Zealand which is being produced by an environmental developer, and the third is Aurora, Melbourne Australia, which is being produced by a government development agency, VicUrban. There is a particular emphasis on developer values and actor interactions, as well as the political and institutional processes that influence the adoption of sustainable water management initiatives and energy efficient designs and concepts at these sites. This provides an understanding of New Zealand's and Australia's progress towards 'urban resilience'. This is a concept that is increasingly being used to provide a longer-term, holistic view of sustainable urban development.

Case study analysis was applied as the main method of enquiry to understanding and conducting this investigation. The case studies draw on data gathered from seventeen semi-structured interviews, two focus groups, two fieldtrips and document analysis. The case studies revealed power relations between actors during the development process resulting in internal and/or external 'silo-thinking' and design objective conflicts. Council planners' and urban designers' knowledge and experience, coupled with developers' cost and risk minimisation mindset and potential home purchasers' housing preferences are regarded as the main factors that influence the design and therefore end product of residential developments.

The adoption of sustainable water management initiatives at the three development sites was influenced by council plans and developers' desire to add amenity for marketing purposes. The complexities of design, maintenance and health concerns were the main factors that can influence the adoption of sustainable water management initiatives. There are no mandates that require energy efficient designs or concepts at the three sites and therefore such initiatives shown at two sites (Kirimoko and Aurora) were voluntary design approaches. The reluctance to incorporating such design approaches stems from a current market and psychological resistance to paying for and realising the benefits of active and passive solar design.

This thesis suggests that greater political leadership, financial incentives and further research carried out on urban governance configurations, consumer preferences and the economic benefits of sustainable urban design are required to ensure progress towards urban resilience and reduce cities' vulnerability to peak oil and impacts on climate change.

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Chapter One: Introduction

> *"The cities of the twenty-first century are where human destiny will be played out, and where the future of the biosphere will be determined. There will be no sustainable world without sustainable cities" (Benton-Short & Short 2008: p28).*

Cities currently support approximately half the world's population. This figure is estimated to increase to 60% by 2030 (Newman, Beatley & Boyer 2009). About nine out of ten people in Australia and in New Zealand live in cities, with both countries having had a majority urban population for a century or so. There is therefore unlikely to be a sustainable world without sustainable cities, especially when the consumption patterns of most urban dwellers are taken into account. However, the terms 'sustainability' or 'sustainable urban development' are becoming more popular in urban governmental discourse. But why does urban development continue down an economic growth, cost efficient design approach, when better environmental, social and built outcomes, and potential financial rewards, could result from doing things differently? The paradox is identified by Newman et al. (2009). They discuss 'urban resilience' as an emerging concept that involves collective initiatives designed to promote a longer-term, holistic 'vision' for urban communities to progress towards a 'sustainable world'. This research will investigate three urban development sites, two in New Zealand (Wigram Skies in Christchurch and Kirimoko in Wanaka) and one in Australia (Aurora in Melbourne) which are claiming to be developed as 'modern', innovative' and 'sustainable' urban communities. The locations of these sites are illustrated in Figure 1. Through the use of case studies, the thesis will explore whether these developments are 'resilient' to current and future urban challenges and assess the extent to which they embody new forms of urban built outcome.

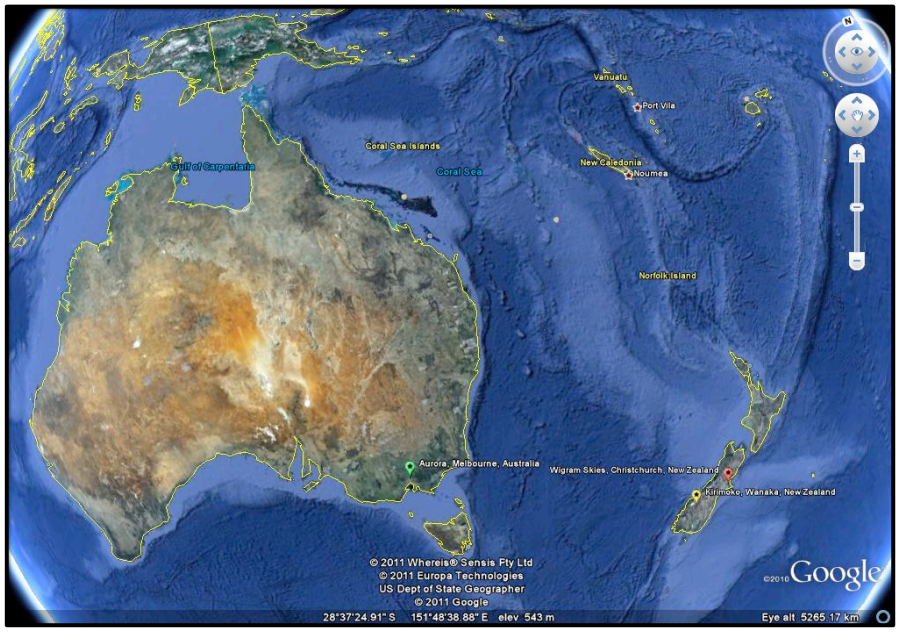


Figure 1: Location of Wigram Skies, Kirimoko and Aurora.
Aurora, Melbourne, Australia is indicated by the green marker. Wigram Skies, Christchurch, and Kirimoko, Wanaka, New Zealand are indicated by the red and yellow markers respectively.

Research Argument

Ever since humans began to craft cities and villages for settlement there has been a realisation that development activities affect the environment and that the environment in turn helps to shape human development activities (Benton-Short & Short 2008). However, this realisation has not always meant that cities and communities were designed and built to alleviate the long-term adverse environmental and social impacts that can result from settlement. Even though scholars and practitioners testified to the importance of 'green' communities and walkable urban environs as early as the 1890s (Ward 1992) it was not until the political emergence and potential impacts of climate change, peak oil, and resource scarcity and degradation in the 1980s that governments and professionals started to consciously strategise new pathways for urban development to reduce detrimental effects on environmental, social and economic systems.

Cities are fast becoming the preferred environment for humans due to their expanding economic, employment, housing and resource opportunities, and the spaces they provide for social interaction and recreation. Whilst cities provide a lifestyle preference and expanding opportunities for inhabitants through processes of globalisation, they are also large contributors to environmental disruption, within and beyond their boundaries (Newman & Jennings 2008). As a city grows and adapts its physical landscape to accommodate demographic changes, the inputs of water and energy, and resulting outputs of noise, sewage, garbage and air pollutants also increase (Benton-Short & Short 2008; Newman & Jennings 2008). This reality means that cities currently consume an estimated 75% of the world's energy and emit 80% of the world's greenhouse gases (GHGs) with the potential to influence further changes to the earth's climate system, highlighting energy consumption as a key area of concern for sustainable urban development (Newman, Beatley & Boyer 2009).

A large portion of the world's energy uptake and emitted GHGs are associated with the industrial revolution, and more recently with the mass production of automobiles and easily accessible and cheap supply of oil. Collectively a resulting urban phenomenon has emerged in many industrialised countries known as 'urban sprawl', whereby the city's boundaries expand and consume valuable agricultural land due to technological innovations, ease of access and population growth (Dodson & Sipe 2008; Newman, Beatley & Boyer 2009; Nuissl & Schroeter-Schlaack 2009). This phenomenon can be linked to the development of auto-dependent and poorly planned low-density residential communities across the globe, most notably in the United States of America, Australia and New Zealand (Buchanan *et al.* 2006; Benton-Short & Short 2008; Dodson & Sipe 2008; Preval, Chapman & Howden-Chapman 2010). Although these sprawling urban areas provide homes and a particular 'lifestyle' for many people, their long-term sustainability is questionable due to their various adverse environmental and social effects. These include: pollution of land, water and air; higher energy consumption; increased risk to natural hazards; loss of public open spaces; physical and mental health problems; loss in sense of community; ecosystem fragmentation; reductions in diversity and species; and higher vulnerability to peak oil and climate change (Yiftachel & Hedgcock 1993; Davis

1996; Voyle & Simmons 1999; Dair & Williams 2006; Barbosa *et al.* 2007; Benton-Short & Short 2008; Bullen *et al.* 2008; Noiseux & Hostetler 2008; Carter 2009; Newman, Beatley & Boyer 2009; Preval, Chapman & Howden-Chapman 2010). These studies also highlight water and energy as important resources for the function of a city, and as issues that are of key concern for progress towards urban resilience. For example, buildings consume 48% of total world energy per year due to their design, location, orientation, their relationship with the natural landscape and neighbouring buildings, and occupant energy consumption, accounting for approximately 43% of total carbon dioxide emissions contributing to climate change (Younger *et al.* 2008; Newman, Beatley & Boyer 2009). Conversely, water management plays a pivotal role in the impacts of a city on the environment through its connection with: waste systems, drinking demand, agriculture and household irrigation, energy, and storm water discharge.

It has been argued that although cities, and surrounding residential areas, produce the largest impact on environmental and human systems, they also provide a significant arena through which to address climate change and become environmentally sustainable over the longer-term (Bulkeley & Betsill 2003; Benton-Short & Short 2008). Various studies (Jim 2004; Younger *et al.* 2008; Bowman & Thompson 2009; Carter 2009; Hostetler & Drake 2009; Cherry 2010; Higgins 2010) conducted on 'urban design' and 'sustainable urban development' emphasise the benefits of implementing sustainable infrastructure into residential landscapes and urban design strategies, such as green space, energy efficient technologies and sustainable transport options (active and public). The benefits to society and the environment include: reduction in greenhouse gas emissions; reduction of pollution into receiving environments; reducing dependence on oil and automobiles; improving health and longevity; promotion of physical activity; higher quality of life; improved conditions for child development; increasing social interactions in communities; increasing the aesthetic value of urban areas; increasing property values; and saving money through energy efficiency (Yiftachel & Hedgcock 1993; Dair & Williams 2006; Noiseux & Hostetler 2008). Nonetheless, despite such options, a paradox of sustainable urban development emerges whereby urban residential development in many countries seems to continue down an economic growth and cost efficient, or least cost, urban design approach, even though many governmental authorities are aware of the positive human health and environmental outcomes of creating built environments that implement more sustainable urban infrastructure and design techniques.

A number of studies (Dewick & Miozzo ; Jones, Leshman & MacDonald 2009; Newman, Beatley & Boyer 2009) have sought to assess the perspectives of developers and planning professionals in relation to 'green' residential developments, highlighting barriers to constructing sustainable communities, such as consumer, regulatory and political constraints. However, they do not explore why the practices of urban development professionals and the urban governance system are not consistent with modern sustainable urban design initiatives and planning concepts in New Zealand and Australia. Cities such as Christchurch, Auckland, Sydney, Melbourne, and Adelaide are characterised by sprawling low density, auto-orientated suburbs. This is despite there being a plethora of research evidence in Australasia that emphasises sustainable urban design and

infrastructure, such as, low impact storm-water design, energy efficient technologies, higher density and active transport orientated design, as better options than traditional suburban development. Therefore this thesis will investigate whether residential developments in New Zealand and Australia are 'resilient' to current and future urban challenges and assess the extent to which they embody new forms of urban built outcome. A series of aims and objectives are outlined below.

Aims and Objectives

This research will *explore the paradox that urban development continues to follow a 'business as usual' path, even though the advantages of 'breaking the mould' through the adoption of sustainable urban design strategies and initiatives are well known*. The research will focus on the extent to which sustainable urban development is practiced in Australasia through investigating three urban development sites. This first is Wigram Skies, Christchurch, New Zealand, which is being produced by an indigenous New Zealand Maori development agency, Ngai Tahu Property Corporation, and is being marketed as a development that is "setting the standard for modern, innovative and convenient living" in Christchurch (www.wigramskies.co.nz). The second is Kirimoko located in Wanaka, New Zealand, which has taken a landscape based, low impact storm-water design approach and features 'conservation subdivision' design principles advocated by the developer. This is an approach rarely taken by private developers in New Zealand. The third is Aurora, located in Melbourne, Victoria, Australia, which is being produced by a state government development agency, VicUrban, and is being developed to demonstrate 'best practice' and 'environmental leadership' in terms of greenfield residential development in Victoria (www.vicurban.com). These case studies will provide comparisons of development practices and urban governance processes between regions and countries to highlight similarities and differences. Three objectives have been formulated to guide the overarching aim to understand the paradox of constructing sustainable residential communities.

The first objective is *to identify the range of key actors involved in the development process at each development site and examine the extent to which they themselves are barriers in the process of constructing sustainable residential communities*. This aspect of the research will examine the actors involved in the development process of the three developments identified above. However, given that developers take the financial risk and play a vital role in supplying demand for housing, there will be a particular focus on developers' visions and values, as it is these 'visions' and 'values' that direct their developments and influence the quality of the residential outcome.

The second objective will draw on the recognition that water and energy are important factors for the functioning of a city and creating sustainable communities. It will *examine and assess the development process at the three sites, to identify the political and institutional elements that influence the adoption of sustainable water management initiatives and energy efficient designs and concepts*. The three sites outlined above will provide useful comparisons, not only in the built form outcomes and developer typologies, but also the range of issues, and actor interactions and relationships that interplay at different urban locations. This research is essentially concerned with barriers to creating sustainable residential communities and therefore the final objective will *provide an understanding of*

progress in New Zealand and Australia towards sustainable urban development and illustrate whether the creation of 'resilient' residential communities can be successfully embedded into urban policy and planning strategies to reduce impacts on climate change and vulnerability to peak oil.

The next two chapters provide a contextual framework for exploring the paradox of sustainable urban development. Chapter Two outlines contemporary and future urban challenges followed by Chapter Three, which details Australasian urban governance configurations to provide context to Chapters Five, Six and Seven. These three chapters will each explore the extent to which a particular urban development represents resilient urban form and how urban governance influences the implementation of water management initiatives and energy efficient design. Chapter Eight discusses concluding comments.

Chapter Two: Urban Resilience

There are many ideas about the origins of urban settlements, although Pacione (2005) argues that no one theory is sufficient to account for the network of social, economic and political processes that have produced the emergence of urban forms. To understand current and future urban challenges it is useful to consider some of the historical drivers behind urban transformations. This chapter will therefore begin with a conceptual framework outlining how New Zealand and Australian urban settlements evolved and became characterised by sprawling cities. To do this, the concept of time-space convergence is introduced. Following on from this, the consequential environmental and social effects of urban sprawl will be explored, as well as the future challenges of climate change and peak oil. The themes are then drawn together using the concept of 'urban resilience' as a holistic approach towards sustainable urban development and the reduction in urban sprawl effects.

Historical Urban Development and Contemporary Suburbia in Australasia

Urban geographers have long recognised 'place' as a central concept in the analysis of how urban areas are constructed and come to have meaning for their residents (Tuan 1977). Places are unique locations that are both the product of social, environmental and economic processes as well as localities that contribute to a person's sense of identity and sense of community (Massey 2005). Henderson (2009) sees place as a geographical locale of any size or configuration that can be defined as a human produced transformation of a part of the earth's surface or pre-existing, undifferentiated space, such as the moulding of 'nature' into an urban form. From a temporal position, Shields (1991) uses the term 'social spatialisation' to designate the ongoing social construction of space through imagery and interaction with the physical landscape, where separate objects are brought together to create an interconnectedness of space and place. Tuan (1978) and Graham and Healey (1999) agree space has a direct relation to place, whereby spaces are produced and created by social actions within and between places. This is supported by Tuan (1978) who also states that 'time' is present in urban spaces and places, whereby the "city is time made visible" (Tuan 1978). Tuan's (1978) concept of the city as 'history incarnate' can provide insight to the events, decisions and aspirations of past urban dwellers and explain the present shape and substance of a city, thereby

indentifying ‘time’ and ‘space’ as important aspects when attempting to understand the interrelationships of human interaction and development patterns.

The relationship between time and space and their influence on development patterns can be explored through Donald Janelle’s (1968) concept of ‘time-space convergence’, whereby a temporal pattern is evident in every spatial pattern. Janelle (1969) defines time-space convergence as the decrease in friction of distance, or time, between places, such as the city to rural, brought about by transport innovations. By transport innovations, Janelle (1969) is referring to any technology or method that increases accessibility between places or increases the number of goods or passengers between places, such as faster types of carriers, improved traffic routing procedures, better gasoline or improved travel routes. The classic illustration of the concept of time-space convergence is shown in Figure 2 below which depicts the significant transport innovations that reduced time-area between Edinburg and London, United Kingdom between 1658 and 1966.

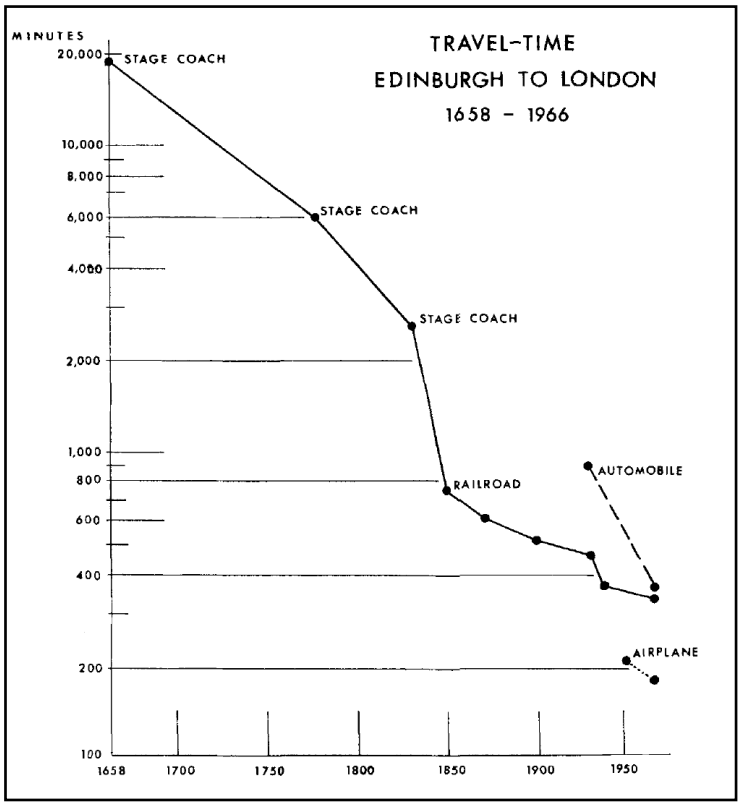


Figure 2: Time-space convergence.
Janelle’s (1968) diagram showing the decrease in time-area between Edinburg and London through advances in transport (Source: Janelle, 1968, p6).

Most research on time-space convergence has tended to focus on time-area between towns, cities or countries, such as in New Zealand, the United States of America (USA) and the United Kingdom (UK) (Janelle 1968,1969; Pawson 1992). However, Janelle (1969) signals the adaption of time-space convergence from ‘extra-urban’ to ‘intra-urban’, stating that the centralisation and specialisation of urban areas increases the need for efficient transport and accessibility, resulting in convergence between interacting urban environs (Janelle 1968). As intra-urban transport advances have emerged

surrounding environs and resources have became more accessible (Janelle 1969): implying that improvements in intra-urban mobility have made it possible for people and businesses to trade off central accessibility for the amenities of the suburban 'lifestyle'.

Frost (1991) uses this concept in his discussion of Australasian cities. Most of these were a product of the second half of the nineteenth century, and had the advantage of developing through the use of modern transport technology to disperse urban populations and to encourage the suburban utopia that emerged from European industrial dystopia. Hinde (2010) supports this analysis, explaining that aspirations for clean, tranquil living in the suburbs during early stages of Melbourne's development were ideas imported from Britain. There the wealthy were setting up homes in suburbs to avoid industrial pollution, thereby motivating planners to develop low-density housing away from city centres. Melbourne residents' aspirations for a suburban 'lifestyle' were supported by the electric tram and rail services developed by 1906 and 1919 respectively (Laird & Newman 2001). Forer (1978), in his study of Christchurch, highlights the increased attraction for privately owned detached houses on 0.10 hectare (quarter acre) plots. This desire for added amenities was encouraged by increasing levels of mobility, such as the development of the electric tram service in 1916 by local land speculators (Laird & Newman 2001). Australasian suburbs dispersed and expanded with railway and tram-line extensions; residential developments clustered around railway stations and rail or tram corridors so that residents had easy access to and from the city or places of employment. The ongoing use of electric railways and tramlines during the early twentieth century continued to shape land-use patterns and the development of suburbs by reducing the commuting time from city to suburb in Australasia. This effectively laid the foundations for 'suburbanisation': the process where the resident population of the outer ring of the city grows faster than the population of the inner core (Laird & Newman 2001; Pacione 2005).

Although the early emergence of suburbanisation is evident in the UK (Mace, Rob & Nigel 2009), Bourne (1996) argues that the phenomenon was first evident in the United States of America (USA) after the Second World War. This followed a housing boom produced by public policy that encouraged the construction and purchase of new homes, and the construction of highways in preference to mass-transit. The dispersal of the suburbs that resulted was aided by technological advances in reducing intra-urban commuting, such as the mass production of automobiles and the readily availability of cheap supply of oil (Bourne 1996). Gunder (2002) analyses the values and ideals implemented by USA influenced motorway construction in Auckland in the 1950s, which likewise in turn created a sprawling Auckland urban region. Dodson and Sipe (2008) convey a similar message for Australian cities, whereby the highway system and motorcar reduced commuting time to suburbs through easier accessibility. The need for highway development was influenced by the dominant desire among residents for homeownership for the 'quarter acre dream home' and relatively high incomes making it possible for people to afford the commute (Gunder 2002; Dodson & Sipe 2008; Coleman 2010; Preval, Chapman & Howden-Chapman 2010). In addition, government policies in Australasia encouraged homeownership through the deregulation of the mortgage finance sector

and implementing transport policies that encouraged automobile dependence and the sprawl of suburbs (Gunder 2002; Dodson & Sipe 2008).

Today, suburban areas in Australasia are characterised by spatial sprawl of low density housing which is largely car orientated and serviced by strip malls and bulk retail outlets. This is due to the persistence of an urban design approach that accommodates the increasing use of automobiles on wide roads and the production of low-density large detached houses. This is the favoured format amongst small and large development companies. As seen in Figure 3 and Figure 4 below, developers promote and market new city edge subdivisions as sites of 'lifestyle' values. The subtext is that of strong social cohesion combined with amenities and an escape from 'city life' (Laird & Newman 2001).

Figure 3 (top): Riverside Park, Wanaka. Source: www.infinitywanaka.com
Figure 4 (bottom): Aspect, South East Melbourne. Source: www.vicurban.com
Both figures illustrate the car orientated, large home design of new subdivisions, as well as the added amenities and social cohesion aspect.

Consequential and Future Urban Challenges

Although urban sprawl provides alternative perceived 'lifestyles' to city life, various authors (Bourne 1996; Newman & Jennings 2008; Hostetler & Noiseux 2010; Noiseux & Hostetler 2010) argue that sprawling suburbs shape the social fabric of the communities that reside within them in negative ways. New residential communities have become anonymised, emphasising privacy, reduced sense of community, alienation and anti-social behaviour. In addition, there is emerging literature that relates lack of physical activity to low-density sprawling neighbourhoods that are reliant on automobiles for daily travel. This essentially depicts suburbs as obesogenic built environments (Badland & Schofield 2005; Badland *et al.* 2009; Witten, Pearce & Day 2011). On top of this, suburban sprawl has produced greater separations between work, home, school and retail, increased traffic congestion, a disregard for public space and reduced access to amenities (Buchanan *et al.* 2006; Preval, Chapman & Howden-Chapman 2010). Such reduced access highlights a reversal of time-space convergence to

time-space divergence, a concept Knowles (2006) suggests occurs when commuting times become slower or longer due to route congestion, lower speed limits, or transport services taking circuitous routes. It can be argued that the evidence provided here is the opposite of how developers' market their developments, adding to the paradox argument and raising questions about suburban social sustainability.

In addition the paradox can be illustrated through arguments about the environmental costs of urban sprawl. Urban developments are often built on plots of greenfield land. These are undeveloped areas of land in a city or rural area generally used for the purposes of agriculture, landscape design or left to evolve naturally. It can be open fields, open lots, or private or government properties. In Christchurch, Melbourne and Wanaka, many urban developments are produced on greenfield sites that were traditionally used for agricultural purposes. The local environmental implications of urban sprawl on greenfield sites has been widely acknowledged (Benton-Short & Short 2008; Cadieux 2008; Hostetler, Allen & Meurk 2011) and include adverse effects on water bodies, land, and air through increased pollution levels. These urban forms have a high reliance on private motor vehicles and their carbon emissions affect local air quality and can place short-term and long-term effects on human bodily systems, such as the respiratory system (Denison *et al.* 2001; Fisher *et al.* 2002). Furthermore, the vast networks of roads that accommodate transport increase the amount of paved surfaces in the suburban environment and, coupled with hard, concreted storm water drains, act as a conveyance system for sediment and chemical pollutants to be deposited into receiving water bodies, such as rivers, streams and the ocean, affecting water quality levels which can be detrimental to aquatic life and local biodiversity (McColl & Hughes 1981; Paul & Meyer 2008). Low density suburban environments are also associated with higher water consumption, higher domestic energy consumption for heating and cooling buildings, and higher waste production from cities' increasing consumption and consumerist attitudes (Benton-Short & Short 2008; Newman & Jennings 2008).

Even though governments attempt to restrict urban sprawl and protect agricultural land through creating 'urban growth boundaries' (development zones) around cities and encourage urban consolidation and sustainable urban development, the reality is that increasing pressures of population growth forces local governments to readjust these zones to allow developers to supply housing demands on affordable land, essentially continuing the urban sprawl dilemma. Coupled with this, many new residential developments on the fringes of New Zealand and Australian cities are being designed and developed with little or no regard to sustainable urban design initiatives, potentially intensifying the future urban challenges of peak oil and climate change.

Peak oil and energy

Peak oil, which was first conceptualised by M. King Hubbert in 1956, is a point in time when the maximum rate of oil extraction occurs resulting in a decline in oil production (Archer & Rahmstorf 2010). Archer and Ramstorf (2010) explain that the remaining oil reserves are estimated to be close to 100Gton for a total original oil supply of 200Gton: essentially stating oil extraction is at its peak today or in the close future. Krumdieck et al. (2010) affirm that the prospect of peak oil is no longer a

subject of speculation and is emerging as an important urban planning issue. The flexibility for adaptation will depend on urban form, infrastructure and the built environment. The main sources of global energy at present are oil at 36.8 per cent, coal at 27.2 per cent and gas at 23.7 per cent. The remaining 12.3 per cent is taken up by hydro or nuclear power (Hodgson 2010). New Zealand meets its energy needs from a range of sources, including both renewable (hydro, geothermal, wood, wind, biogas and solar) and non-renewable (oil, gas and coal). As seen in Figure 5 below New Zealand relies for 63% of its energy use on non-renewable energy sources. New Zealand's built environment accounts for 45 per cent of total electricity use (22 per cent commercial and 23 per cent residential) and 17 per cent of total carbon emissions contributing to climate change (Zari 2009). Australia's energy supply comes from black or brown coal (39%), petroleum products (34%), natural gas (21%) and renewable (5%). Its electricity is mainly being produced by coal combustion (77%), with the balance from gas (15%) and renewable energies such as wind, solar, hydro and biomass/gas (8%). Australia accounts for approximately 1.5% of global green house gas emissions and 70% of that comes from energy consumption across the country (www.ret.gov.au).

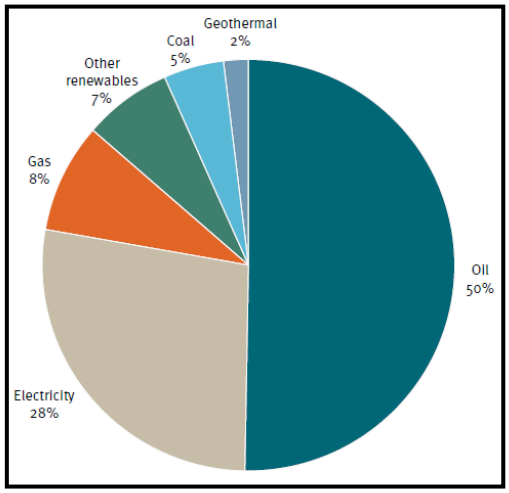


Figure 5: Consumer energy demand in New Zealand by fuel type, 2007.
Source: Ministry of Economic Development, 2008.

Based on this data, New Zealand is doing relatively well compared to Australia in terms of renewable energy production. However, virtually all the non-renewable energy sources are present in everyday aspects of modern life, from lighting or heating homes and buildings, transportation, producing consumer products, and powering communications and factories (Hodgson 2010). The primary energy supplies for New Zealand and Australia - oil, coal and gas - are finite resources and are being consumed at an increasing rate. They will soon become difficult to extract leading to higher prices for energy, goods and services, and reductions in their availability for dispersed urban residents (Hodgson 2010). Given the current state of sprawling auto-dependent Australasian cities, the decline in oil, and therefore petroleum production, will affect urban transport modes, such as reduced access between urban environs and to services due to high priced fuels and inadequate sustainable transport infrastructure. The urban development industry may also be affected by the increase in transportation costs of construction materials and increased competition for land closer to sustainable transport

corridors, such as tram/rail/bus routes, pushing land prices up. Collectively the costs of these potential impacts, and the costs of creating renewable energy generation and transport infrastructure, would be transferred to the consumer. Many would not be able to afford such costs, resulting in high levels of socio-economic stress and inequalities.

Global and regional climate change

The ever increasing consumption of non-renewable, fossil fuel energy sources for global industrial development and urban land-use are also contributing to global scale and regional climate change. Although uncertainty remains regarding our knowledge about climate, the basic processes that cause climate change have been well established, and human activities have been identified as the main driver for climate-induced trends during the last several decades (Archer & Rahmstorf 2010). The International Panel on Climate Change (IPCC) collected scientific records show that the earth's average surface temperature has increased by about 0.75 degrees Celsius since the mid-nineteenth century (Mastrandrea & Scheider 2010). The increase in temperature is related to increasing concentrations of the GHGs carbon dioxide and methane. This is due to human activities, primarily from the burning of fossil fuels for transportation and industrial uses, but also deforestation and other land-use changes. These have contributed most to changes in climate through the intensification of the greenhouse effect, consequently increasing the earth's temperature further (Dawson & Spannagle 2009; Archer & Rahmstorf 2010; Mastrandrea & Scheider 2010).

Carbon dioxide is the dominant GHG responsible for global warming temperatures as it has a longer lifespan in the atmosphere than other human released GHGs. Methane is a relatively short-lived gas in the atmosphere but has a warming potential 25 times that of carbon dioxide on a 100 year time scale (Dawson & Spannagle 2009; Archer & Rahmstorf 2010). In 1996 the concentration of carbon dioxide was 361ppm and rose to 379ppm by 2006. The rate of atmospheric carbon dioxide rise is increasing, growing 20% faster in the period 2000-2004 than in the 1990s. The rate of emissions has accelerated in recent decades, up 37% since the 1980s (Archer & Rahmstorf 2010). In 2011, as measured by the Maua Loa Observatory in Hawaii, atmospheric concentrations of carbon dioxide were around 393ppm (co2now.org). The rise in concentration, Archer and Ramstorf (2010) explain, is due to the human release of carbon dioxide, from fossil fuel combustion, deforestation, and cement manufacture – largely for use in urban development. The reality is that carbon dioxide increase is well documented and is well-established by climate science, and to stabilise climate change means reducing the anthropogenic emissions of carbon dioxide and methane into the atmosphere. Archer and Ramstorf (2010) present IPCC data that suggest global temperatures are expected to rise 1-2 degrees Celsius by 2050 and 2-5 degrees Celsius by 2100 under current trends. As climate varies from region to region, due to the physical characteristics of the landscape and relationship to oceans, so will the expected changes in climate. As this research is concerned with New Zealand and Australia, the impacts of climate change will be explained in relation to these regions.

New Zealand

A document produced by the Ministry for the Environment (MfE, 2008) suggests that New Zealand has already experienced an increase in average temperatures and impacts of climate change are now evident in water supply, agriculture, natural ecosystems and in loss of at least a quarter of glacier mass (Fitzharris 2007). Hennessey et al. (2007) indicate rainfall has increased in the south-west and decreased in the north-west, with this trend expected to become more frequent and intensive, along with other extreme events, such as floods, landslides and droughts. New Zealand mean air temperatures have increased by 1.0 degrees Celsius between 1855 and 2004, and by 0.4 degrees Celsius since 1950 (Hennessey *et al.* 2007). Moreover, Fitzharris (2007) indicates New Zealand's climate is 'virtually certain' to be warmer by up to 4 degrees Celsius by the end of the 21st Century. Large areas of eastern New Zealand will become drier and runoff from smaller rivers will be reduced, although there will be increased runoff for larger rivers due to more precipitation in mountain regions (Fitzharris 2007). As a result water security problems are projected to intensify by 2030 in some urban areas, especially in Northland and eastern regions of the North and South Islands, such as Hawkes Bay, Marlborough and Canterbury (Ministry for the Environment 2001; Fitzharris 2007).

Western New Zealand is expected to become wetter by up to 35% in some seasons, with considerable increases in runoff placing stress on floodplain protection measures around urban settlements (Fitzharris 2007). In addition, the Ministry for the Environment (MfE 2001) indicate increased intensity and frequency of rainfall across New Zealand will increase peak flows in urban catchments, placing greater pressures on storm-water and waste-water infrastructure. As well as this, continuous urban development and urbanisation near coasts and estuaries will increase risks from sea-level rise and increase the severity of storms surges and coastal flooding by 2050 (Fitzharris 2007). New Zealand's urban environment risks include failure of floodplain protection and urban drainage/sewerage, increased storm and fire damage, and more heat waves and electricity blackouts in large cities, such as Auckland and Christchurch (Fitzharris 2007). In addition, there is expected to be considerable loss of biodiversity by 2020 in some ecologically important sites, including lowland eastern native forests and alpine areas. By 2030 there is likely to be fragmentation of native forests in drier lowlands, 33-50% loss of indigenous alpine plants and 10-40% less snow cover in the Southern Alps (Fitzharris 2007).

Australia

Australia is also experiencing similar effects of climate change, such as warmer temperatures, rising sea-level, increased intensity and frequency of droughts, flooding and tropical cyclones (Hennessey *et al.* 2007). Maximum temperatures in Australia have risen 0.6 degrees Celsius between 1910 and 2004, and minimum temperatures have also increased 1.2 degrees Celsius, mostly since 1950 (Hennessey *et al.* 2007). North-western Australia has experienced an increase in summer monsoon rainfall, with southern and eastern parts of the country becoming drier, with trends expected to continue (Hennessey *et al.* 2007). With Australia's water demand increasing, up 65% during the period 1985-1996, and precipitation decreasing in some areas, the main future problems for many urban regions are likely to be drought and water shortages (Archer & Rahmstorf 2010). The frequency of drought is expected to increase 20% by 2030 over most of Australia, and up to 40% in south-east

Australia and 80% in south-west Australia by 2070, resulting in disruptions to electricity generation and reliability (Hennessey *et al.* 2007). In addition, more than 80% of Australia's population live near coasts and with population increasing, 20 million in 2003 to 26.4 million in 2051, urban coastal zones are at risk from sea-level rise (Hennessey *et al.* 2007). As early as the year 2020, significant losses of biodiversity are also expected in some of Australia's most valuable ecosystems, such as the great barrier reef, the kakadu wetlands, and mountain regions.

For both Australia and New Zealand extreme events can produce severe impacts, not just physically and socially but also economically. In Australia, around 87% of economic damage due to natural disasters (floods, droughts, storms, cyclones, fires and landslides) is caused by weather related events. The cost of these averaged US$719 million per year during the period 1967-1999, mostly attributed to floods, storms and tropical cyclones (Hennessey *et al.* 2007). Other than earthquakes and droughts, floods are the most costly natural disaster in New Zealand with total damage costs averaging about US$85 million per year during the period 1968-1998 (Hennessey *et al.* 2007). It could be argued that these economic costs will only increase as the effects of climate change continue, thus planning of urban environments needs to take into account the long-term costs and implications of climate change in order to reduce economic damage and social disruption. Even though global warming has been small as yet, the consequences of warming are clearly evident, with changes in climate increasing the frequency and intensity of existing hazards and risks (Ministry for the Environment 2008; Archer & Rahmstorf 2010). It has been identified by the Organisation for Economic Co-operation and Development (OECD) that cities are major contributors of increasing carbon dioxide emissions and it is human 'lifestyles' and urban sprawl that lie at the heart of the problem (www.oecd.org). Therefore cities must take sustainable actions to reduce environmental disruption to provide inhabitants with a healthy, 'sustainable lifestyle'.

Sustainable Urban Development

Rethinking the way we create our built residential areas in a way that produces more adaptable and less vulnerable urban forms that will lessen dependence on oil, reduce our influence on climate change and reduce the impacts of cities on environmental and social systems is generally conceptualised as sustainable urban development. This concept emerged in the global public arena in the 1987 Brundtland Report, *Our Common Future*, which was a product of the World Commission on Environment and Development (WCED). It outlined how current human development activities were affecting the climate system, depleting natural resources, and degrading land, water and air resources. The report developed the idea of sustainable development to guide governments in establishing policies and strategies that reduced adverse effects of human development activities. This concept was defined by Brundtland in the now overworked phrase as 'the ability of humans to meet the needs of the present without compromising the needs of future generations'. This is illustrated in Figure 6 which depicts three constituent elements of sustainable development: economy, society and environment. Each element is not mutually exclusive, but rather interconnected with the others resulting in balanced outcomes through economic development, social development and

environmental protection, or ‘sustainable development’: simply put, where the three pillars interact in the middle to produce a positive outcome is ‘sustainable development’ (WCED 1987).

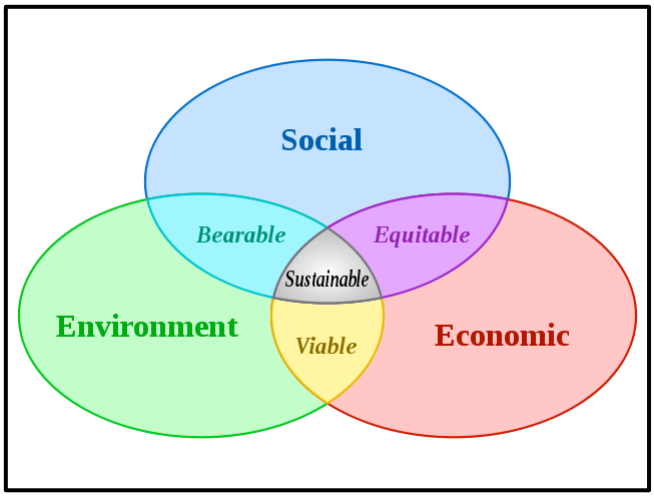


Figure 6: Illustrated concept of sustainable development.
Each pillar interacts with each other and when the three pillars meet collectively in the middle produces sustainable development practice (Source: en.wikipedia.org).

In regards to the urban environment, sustainable development emphasises developing built forms, infrastructure and systems that reduce human development impacts on the environment, provide healthy places to live, work and play, while providing an economically competitive market (Athanassakis 2009). There are numerous examples of sustainable urban initiatives which help to progress towards sustainable urban development, such as: encouraging active transport through constructing cycleway and walkway networks; constructing mixed land-use developments; providing adequate public space and green-space networks to encourage social interaction or social sustainability; providing accessible public transport; and developing renewable energies from wind, solar and water to power homes and businesses. These initiatives are evident in many urban design concepts which attempt to move away from environmentally degrading sprawling developments, such as Transit Orientated Development (TOD), New Urbanism and Conservation Subdivisions (CSD).

TODs provide a more sustainable alternative to sprawling urban developments with the construction of mix-use residential and commercial areas that are concentrated around public transport stations to maximise access to public transit options (Bertoluni, Curtis & Renne 2009). A TOD is generally characterised by a transit stop or station at the centre of the urban form and is usually surrounded by high-density development with lower-density developments spreading outwards (Bertoluni, Curtis & Renne 2009). This type of development increases accessibility to public services, increases social interaction through the use of public transit and public spaces, and reduces auto-dependence. New Urbanism is a popular alternative to car-orientated sprawling developments and has been used widely throughout America (Stevens, Berke & Song 2009). New Urbanism developments use a variety of features to encourage sustainable behaviour, such as compact high-density, mixed-use

neighbourhoods with convenient public transit, bicycle paths and pedestrian friendly street networks, and strategically placed public-space to foster social interaction (Song & Knaap 2003; McCann, Rob & Nigel 2009; Stevens, Berke & Song 2009). However, New Urbanism developments have been criticised as being too heavily based on urban design principles creating exclusive rather than community orientated built form. As well as this, it has been argued that they do not change the behavioural patterns of residents, such as car use dependency and recycling (Song & Knaap 2003; McCann, Rob & Nigel 2009; Falconer, Newman & Giles-Corti 2010). CSDs also provide an alternative to traditional sprawling subdivisions and their related effects. The central idea is to cluster housing together on smaller lots allowing preservation of important ecological and cultural features in the area (Bowman & Thompson 2009). The benefits of this type of subdivision include: decreased reliance on hard (concrete) storm-water control measures through the use of swales, rain gardens or wetlands; habitat and biodiversity protection through conserving and planting native vegetation; and creating 'natural area parks' that have been shown to have greater influence on home sale prices than 'specialty parks' (Carter 2009). CSDs also reduce the amount of site grading that takes place, effectively reducing the amount of dirt moving costs (Carter 2009). In addition, CSDs might fill a niche in the residential market to attract home buyers who want to purchase homes in areas with high quality green-space and other environmental amenities associated with green-spaces (Carter 2009 p.56).

In saying this, sustainable urban development is often criticised for vagueness of interpretation, whereby different people use the term as a 'buzzword' to explain different visions for the economy, environment and society in order to achieve separate rather than community goals and aspirations (Lele 1991; Tippett, Handley & Ravetz 2007; Lieberherr-Gardiol 2009; Hansson 2010). Moreover, Ahern (2011) adds that traditionally sustainability has tended towards a static conception, whereby sustainable urban development is often envisioned as a durable, stable and presubscribed 'fail-safe' urban form or condition that could persist for generations once achieved. However, it is not something that can be achieved but is ongoing in nature. A 'static' landscape condition cannot be sustainable in the face of unpredicted disturbances and change (Ahern 2011). More recent studies are offering a 'safe-to-fail' concept of 'urban resilience' that anticipates failures and designs systems to minimise failure effects (Ahern 2011). This concept is being put forward as a new perspective or possible solution to the paradox of sustainable urban development (Newman, Beatley & Boyer 2009; Stevens, Berke & Song 2009; Burch 2010; Ahern 2011).

Resilient Urban Development

The concept of urban resilience has regularly been applied to a city's ability to respond to natural disasters, such as earthquakes and tsunamis. Recently, emerging literature theorising 'urban resilience' describes it as a "notion seeking to capture the differential and uneven ability of places to react, respond and cope with uncertain, volatile and rapid change" (Pike, Dawley & Tomaney 2010: p59). Leichenko (2011) and Ahern (2011) use the term to describe the ability of a city or urban system to withstand a wide array of shocks and stresses. Attoh-Okine et al. (2009) also use the concept to explain the resilience of urban infrastructure systems, whereby any organisation or system required

for the function of a society (human and non-human) has the ability to recover and adapt to external shocks, such as natural intentional and technogenic disasters and failure due to poor design. More commonly, it is widely being used to provide a longer-term view to urban sustainability and is now being applied to urban environments to explain their vulnerability and adaptive capacity in the face of climate change and peak oil (Coaffee 2008; Newman, Beatley & Boyer 2009; Stevens, Berke & Song 2009; Steele & Gleeson 2010). Newman et al. propose that resilient urban forms will incorporate a mixture of sustainable design concepts and initiatives which produce systems that can adapt to change, such as diversity of transport and land-use systems, and multiple sources of renewable energy that will allow a city to survive fuel supply shortages. Newman et al. (2009) propose seven key elements to creating a resilient city or community, as illustrated in Table 1 below.

***Table 1*: seven key elements to creating resilient urban communities (Source: Newman et al., 2009).**

Resilient element	Resilience description
1. Renewable energy: Urban areas powered by renewable energy technologies from the region to the building level.	Utilising passive and active solar design, wind, geothermal, biomass/gas or hydropower to provide energy efficient buildings.
2. Carbon neutrality: Energy home, neighbourhood and business will be carbon neutral.	Minimising the carbon footprint of communities through reducing energy use in the building and transport sector by utilising renewable energy sources and offsetting carbon emissions through purchasing carbon credits or tree planting.
3. Distributed: Cities will shift from large centralised power, water, and waste systems to small scale and neighbourhood-based systems.	Shifting from centralised production facilities to decentralised energy production systems so that power is supplied close to where it is consumed, reducing the amount of energy it takes to transport it. This method is generally referred to as 'distributed generation' and can be achieved through local wind turbines, local biomass CHP (Combined Heat and Power) plants or rooftop photovoltaics. Distributed production can also be applied to waste water recycling or water supply systems.
4. Photosynthetic: The potential to harness renewable energy and provide food and fibre locally will become part of urban green infrastructure.	'Green infrastructure' is any green or ecological feature or system, from wetlands to urban parks, that provide various benefits to urban residents, and is extended here to include areas of potential renewable energy sources, and local food and fibre. These areas may be located on vacant lots or on roof tops and emphasise mixed-use areas within the city or community.
5. Eco-Efficiency: Cities and regions will move from linear to circular or closed-loop systems, where substantial amounts of their energy and material needs are provided from waste streams.	Rather than seeing solid waste and waste water as negative outputs, this element envisions outputs to be productive inputs to supply urban needs of energy or water, emphasising the city as a metabolic system.
6. Place-based: Cities and regions will understand renewable energy more generally as a way to build the local economy and nurture a unique and special sense of place.	Localising the production of renewable energy, food and materials will create local jobs and strengthen community bounds. This social capital will become the basis for ongoing community life and economic development in the face of peak oil.

7. Sustainable Transport: Cities, neighbourhoods, and regions will be designed to use energy sparingly by offering walkable, transit-orientated options for all supplemented by electric vehicles.	This element envisions the development of faster transit systems compared to traffic in major corridors with high density residential centres to service them, walking and cycling infrastructure that creates better access and connectivity than motorised transport, improvement of vehicle engines to reduce emissions, and bringing in congestion taxes to fund active and passive transport infrastructure.

By closely examining Table 1 it can be seen that the central tenets of urban resilience are diversity and connectivity: diversity and connectivity of transport modes, places and spaces, and their connectivity to a diverse array of renewable energy sources. The transition towards urban resilience through the adoption of these elements will not occur in rapid progression as there are various political and cost constraints across all sectors (public and private) restricting the adoption of such ideas and designs (Newman, Beatley & Boyer 2009). However, there are communities across the globe that are making important steps towards increasing their urban resilience and display some of Newman et al's (2009) elements. For example, the city of Freiburg in Germany has become well known for its extensive use and production of solar panels which can be seen on the rooftops of churches, schools, sport stadiums, city hall and private houses, not to mention that the production of solar panels has provided 1,000 jobs in local business operations (www.fwtm.freiburg.de). Also, Masdar City near Abu Dhabi in the United Arab Emirates is proclaiming itself to be the first zero-carbon city with driverless vehicle pods, argon gas insulating rammed earth and steel walls, solar air conditioning, distributed desalination plants, thermal energy and 'beam down' solar plants that use mirrors to concentrate the sun and heat water to generate electricity, as well as distributed photo-voltaics on private buildings (Vidal 2011). There is also a 'transition town movement' or 'transition network' that has been developed by Rob Hopkins in his home town of Totnes, Devon, England, and has been adopted in other countries, such as the USA, Canada, Australia and New Zealand. The transition movement encourages communities to be self-organised to create initiatives that build urban resilience, such initiatives include, encouraging bicycle use, local food production and energy efficiency (www.transitionnetwork.org ; www.transitiontowns.org.nz).

From a construction point of view, green building rating tools have been developed in the USA (LEED), United Kingdom (BREEAM) and Australia (BASIX) that encourage and promote development agencies, architects and home owners towards creating sustainable buildings through better design and construction practices (www.basix.nsw.gov.au ; www.breeam.org ; www.usgbc.org). An assessment and rating system scores urban developments on areas such as: water efficiency, energy efficiency, construction material, waste, indoor air quality, ecology and surface water runoff, accrediting or certifying developments with 'green' credentials, thereby recognising the marketability for environmentally sustainable buildings. The benefits of such systems help to reduce greenhouse emissions from buildings, reduce urban energy and water consumption, and provide home owners with lower operating costs and increasing asset value, and healthier indoor environments. However, the upfront costs of 'green' buildings that incorporate solar technologies, such as photo-voltaics and solar hot water heating, has been identified as a financial constraint from a consumer perspective, thereby restricting their implementation by developers in New Zealand and Australia (Lloyd & Kerr

2008; Roulleau & Lloyd 2008). However, green technologies seen in China and Germany exemplify what Newman et al. see as the 'sixth wave of industrialisation'. This concept coincides with the end of cheap oil and the beginning of resource productivity and investment in 'green' technologies associated with renewable energy generation and small scale water and waste systems.

A move towards a more resilient urban system will require strong regional and local governmental structures and strong public support to enable and encourage the seven elements above. Pike et al. (2010) argue that there is a multitude of definitions to resiliency and a lack of conceptual and theoretical consensus across different disciplines resulting in unresolved theorisations of urban agents, relationships and processes. Pike et al. (2010) elaborate that adaptability and adaptation, which form around agents and processes, are central to understanding how power relations, politics and the uneven contestation and cooperation between capital, labour, governments and society shape and are shaped by development pathways. They define adaptation as the "geographically uneven ways in which strong tightly connected social agents in places respond, cope with and shape movements towards pre-conceived paths in the short run", and adaptability as the "geographically differentiated capacity of loosely and weakly connected social agents in places to interpret, frame and effect multiple evolutionary trajectories over time", emphasising the importance of power relations between actors and the role of governments in shaping resilient urban outcomes (Pike, Dawley & Tomaney 2010: p67).

Summary

This chapter has illustrated how advances in transport technologies have shaped the built form of Australasian cities through increased intra-urban mobility and accessibility. This resulted in an urban sprawl phenomenon and dispersed populations to the fringes of cities. Although a series of adverse effects of urban sprawl have been made known, peak oil and climate change are identified as major planning issues for future urban environs. Urban resilience has been emphasised as a way to respond to these issues. However, as indicated by Pike et al. (2010) there is a lack of research regarding the relationships of the various actors involved in the planning and development of urban form, as well as the political and institutional systems they work within, that restrict progress towards urban resilience. The following chapter will outline the various actors involved in urban development to illustrate their role in shaping urban form.

Chapter Three: Urban Governance

It has been widely acknowledged that cities represent an opportunity for reducing human vulnerability to climate change and peak oil through encouraging sustainable urban development that follows the principles of resilience. However, as noted by Newman et al. (2008) there is a paradox that many new urban development outcomes are lacking resilient infrastructure. Bentley (1999) provides some insight into this paradox. He contends that the built outcomes of residential developments depend on the internal and external economic, political and cultural resources available to each actor and on the rules according to which the various actors deploy the resources they have. Simply put, it is often the power relations between the various actors involved in an urban development that determines the built outcome. In light of this, it is necessary to conceptualise the notion of urban governance within which residential development occurs in New Zealand and Australia. It is also important to note that there is a lack of research carried out on urban governance and the interactions and relationships between actors during the development process, not only in Australasia but also internationally. Therefore, this chapter will outline the actors that constitute the urban governance system in New Zealand and Australia, and explain their involvement in the urban development process to provide context to the case studies in chapters five, six and seven.

Theories of Governance

Creswell (1996) insists that spaces are often used to control people and things, and within these spaces exist power relations between individuals or groups. 'Power' is defined by Corbridge (2009) as the ability of an actor to affect the actions or attitudes of another, therefore power is an expression of the relationships between individuals, agents or actors. Power is often used synonymously with the term authority and in the case of the urban environment, authority operates under a system of governance not government. Governance is the process of governing in which management, power and policy are exercised, while government is the instrument which enacts decisions on social and economic coordination (Painter 2009). Painter (2009) argues that governance can be used to describe any kind of coordination between organisations, groups and individuals, ranging from hierarchical 'command and control' systems, decentralised market forms of interaction or, more commonly, self-organising networks. In terms of urban governance there is a lack of research carried out on the coordination between actors, which in itself has been identified as a possible barrier to adaptation measures to climate change (Winsvold *et al.* 2009). Winsvold et al. (2009) provide definitions of the hierarchical, market and network modes in order to analyse how different actor coordination processes influence the construction of urban form. The three modes are outlined in Table 2 below:

Table 2: Governance modes		
Governance Mode	Definition	Urban example
Hierarchical	Coordination takes place by way of command and control through the existence of a centralist authority with legitimate powers of decision making and means to ensure compliance. Often referred to as the 'modus operandi' of representative government, whereby decisions that are made in the representative body are implemented by public figures in subordinate agencies and departments through a consistent chain of command.	Governmental authorities' regulations and standards
Market	Coordination does not have a centralist authority, rather coordination is achieved through autonomous self-adjustment of numerous operationally independent actors, whereby the sole means of communication between actors is through the 'price mechanism', which is described as decisions and interactions taken by consumers and businesses to determine the allocation of resources between competing uses.	When buildings are produced as commodities for sale, the operation of 'market forces' ensures that only the buildings that appeal to potential buyers will make sufficient profits to be replicated by developers, ensuring that this results in 'what people want'.
Network	Networks represent a mode between hierarchical and market modes. There is no centralist authority and no set patterns of subordination, rather participants in networks are operationally autonomous, but unlike markets are mutually dependent requiring direct communications. Hierarchies and markets leave no room for discussion or compromise (which are key modes of interaction in networks), and unlike hierarchies, networks are self-regulating and informal.	The interactions and relationships between developers, planners, architects, landscape architects and engineers who come together to collectively design and produce urban developments.

DiGaetano and Klemanski (1999) emphasise governance systems in urban environments are not modelled on just one of these modes, but rather a mixture of all three can be evident, and form around a purposive coordination of efforts that often depend on implicit understandings between public and private interests about what should be done and how to carry out decisions. Goldsmith (2001) complements this by arguing that urban governance replicates the wide variety of interests incorporated in an urban area and the assortment of governmental arrangements employed to accommodate these interests, while at the same time ensuring a 'minimum' amount of governmental regulation necessary to guarantee the continued existence of urban life (Goldsmith 2001). Therefore, for the purposes of this research, 'urban governance' is defined as the collective involvement of public

and private actors collaborating and negotiating within a regulatory and statutory framework to ensure the interests of all urban stakeholders are represented in built urban form outcomes.

New Zealand and Australian Urban Governance

Governmental authorities

New Zealand's national governance system is characterised as a 'regionalised unitary state', where national government delegates powers to regional authorities. New Zealand has three layers of government: Central Government, Regional Government, and Territorial or District Authorities. Central Government delegates the priorities of safeguarding the natural, physical or built environments to the Ministry for the Environment (MfE) and the Department of Conservation who then coordinate responsibilities under the provision of the Resource Management Act 1991 (RMA). The MfE provides policy advice, prepares national policy statements and environmental standards for urban regions, and compiles and distributes information on environmental matters, including urban development issues, to Regional and District Councils. The Department of Conservation manages conservation estates, coastal environments, and the conservation of natural and historic resources. Regional Councils, such as Environment Canterbury or the Otago Regional Council, are delegated responsibility for the integrated management of natural or physical resources within their region, including coastal environments, preparing regional policy statements and plans required under the RMA, and determine applications for water and discharge permits. Territorial Authorities, such as the Christchurch City Council, are responsible for providing local infrastructure services and managing land-use activities within their district, which includes preparing district plans and determining applications for land-use and subdivision consents.

The New Zealand urban governance system is shaped by the RMA, which was one of the world's first pieces of integrated natural resource management, urban planning and environment legislation, and was regarded as revolutionary in its institutional arrangements which assigned many former central government responsibilities to local and regional councils (Conacher & Conacher 2000). The purpose of the RMA outlined under section 5 is to "promote the sustainable management of natural and physical resources", whereby 'sustainable management' means to manage "the use, development, and protection of natural and physical resources in a way or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while" sustaining natural and physical resources for the foreseeable needs of future generations, safeguarding life-supporting capacities of air, water, soil and ecosystems, and avoiding, mitigating and remedying potential adverse affects of activities on the environment. In terms of the urban environment, the RMA, under section 72, empowers local authorities to exercise regulatory control by requiring each authority to prepare district plans.

In addition, the Local Government Act 2002 (LGA) helps to shape urban form. Its purpose, indicated in section 10(a)(b), is to "to enable democratic local decision-making and action by, and on behalf of, communities; and...to promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future". Together these statutes provide the framework to

manage land-use and development through defining objectives for: the natural environment, energy, city and cultural identity, urban growth, transport, utilities, subdivision and development, and recreation and open space, as well as establishing living, business, conservation and rural zones with prescribed rules and functions for development activities. On top of this each city or district can prepare growth management strategies (city or district wide) and area plans (sub-sections of the city or district) to further guide sustainable urban development and achieve the purpose to the RMA and the LGA. An example of this is the Greater Christchurch Urban Development Strategy. This is a collaborative product between Environment Canterbury, Christchurch City Council, Selwyn District Council, Waimakariri District Council and Transit New Zealand. It provides a "comprehensive context for making decisions now and for present and future generations" on issues "including the location of future housing, development of activity centres, providing areas for employment and the impact of land use change on transportation networks" (CCC 2007: p4). Council planners, engineers and urban designers, as well as the general public through consultation, all have a certain amount of input into the preparation of these district plan documents and associated rules and standards that apply to urban development. As well as this they are set with the task of reviewing and investigating land-use or subdivision plan changes and consent applications to ensure that the proposed development is in accordance with district plan rules and the RMA.

Any development not identified as a 'permitted' or 'prohibited' activity in the relevant district or regional plan requires resource consent. Jackson and Dixon (2007) state that councils determine resource consent applications using the 'environmental effects-based' criteria contained within their plans. Applicants, such as residential developers, have to identify the environmental impacts of the proposed development and provide evidence on how the development will meet planned criteria and how the applicant will 'avoid, remedy or mitigate' any 'adverse effects' on the physical environment: placing environmental assessments as a central component of the development process thereby implementing section 5(2) of the RMA (Jackson & Dixon 2007). If the developer succeeds in demonstrating to the council that any adverse effect will be 'less than minor', the application for resource consent can be processed on a non-notified basis (Jackson & Dixon 2007). If the developer does not succeed, the application can be taken forward to a public notification process. Within this process any stakeholder can present a submission for or against the proposed development. However many authors (Conacher & Conacher 2000; Dixon 2005; Jackson & Dixon 2007) argue that the 'resource based', 'plan driven' focus of the RMA produces an inefficient, ponderous system of urban planning and plan-making which impedes innovation and results in 'business as usual' approaches to urban development. Perkins and Thorns (2001) also argue that the biophysical emphasis of the RMA creates potential problems for urban development through its limited focus on urban and social planning. Jackson and Dixon (2007) suggest it has slowed the adoption of sustainability principles in social and economic policies.

In contrast, Australia's governance system is a Federal system, where self-governing states operate under a central government. Australia has six states (Queensland, New South Wales, Victoria, South Australia and Western Australia and Tasmania) each with their own parliament and legal frameworks.

In addition, territories within Australia's boundaries which are not claimed by any of the six States can be administered by the Federal Government or can be granted self-government. This allows territories to establish their own governments similar to states. Australia's written constitution shares out powers and responsibilities between national and state governments. The Federal Government has powers prescribed under section 51 of the Constitution of the Commonwealth of Australia, whereby priority policy areas include: social security, welfare, defence, trade and immigration. All other powers not specified in the Constitution are termed residual powers and become priorities of the states. These include: health, education, transport, urban planning and agriculture (Gleeson, Dodson & Spiller). States delegate administrative responsibilities to Local Governments, or municipal councils, who take responsibility for providing community services, maintaining public spaces, and controlling and managing land-use proposals. To clarify, 'municipality' in the context of the thesis refers to a city's borough. For instance, metropolitan Melbourne has 31 boroughs, or municipalities, each with their own local or municipal council.

Australia has no over-arching legislation directly equivalent to New Zealand's RMA, although Tasmania does exhibit something similar in its 'Resource Management Planning System'. Rather urban planning practices are prescribed by individual Australian state government legislation. For example, the guiding legislation for urban development in Melbourne, Victoria, is the Planning and Environment Act 1987 (PEA). Its purpose is to "establish a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of all Victorians". The PEA requires the formulation of 'planning schemes' for each municipality which comprises of a state planning policy framework (SPPF) and a local planning policy framework (LPPF). The SPPF provides general principles for land-use in Victoria and the LPPF sets out a regional and local strategic policy context for a municipality. It comprises a municipal strategic statement which is a concise statement of the strategic planning, land-use and development objectives for a municipality. It is also accompanied by land-use zones and provisions that have local context. The planning schemes are prepared by the relevant municipal authority's planners, development engineers and urban designers. The PEA also establishes an urban Growth Areas Authority (GAA) to ensure that urban growth on Melbourne's fringes occurs in a 'coordinated' and 'timely' manner, and to promote sustainable urban development. The primary function of the GAA is to improve the operation of regulatory and administrative processes over time to reduce the costs and increase efficiencies for developers and local councils when carrying out development. In addition to the PEA, the Victorian Department of Planning and Community Development (DPCD) prepares strategic plans for metropolitan Melbourne, such as: Delivering Melbourne's Sustainable Communities (2010), Melbourne @ 5 Million (2008), and Planning for all of Melbourne (2008), which provide information on population growth and housing capacity, as well as outlining planning objectives to guide sustainable urban development in Melbourne.

Under the PEA, planning schemes, equivalent to the RMA's district plans although are on a municipal basis rather than city wide, are the mechanism for achieving sustainable urban development and environmental protection. They incorporate natural resources, ecological processes and various

social and cultural values at state, regional and local levels through the SPPF and LPPF which outline state and local policy statements. As well as this similarity, urban developments follow a similar process to resource consent applications, whereby 'planning/subdivision permit applications' are required to be in accordance with local planning schemes and policy statements and are subject to public participation and opposing submissions. The primary difference between the PEA and RMA is that the former is based on 'town planning' placing the community and social/cultural values at the centre whilst the latter focuses on resource management and protection. This alone does not mean that the PEA achieves better sustainable urban development outcomes than the RMA, but it does focus development towards urban design principles that provide for the social and economic needs of a community: indicating that the PEA may provide better social sustainability outcomes than the RMA (Conacher & Conacher 2000).

Even though growth and development can lead to an increase in tax base, both in New Zealand and Australia the pressures of population growth and challenges of urban sprawl, climate change and peak oil means that local councils, due to their lack of financial resources, are often forced to accept that they need development more than developers need them due to housing demands that councils cannot supply.

Development agents and agencies

Private developers

The vast majority of residential developments are produced by private developers, ranging from individual homebuilders to small scale developers and larger development companies that produce 'master-planned' communities, leading to the belief that developers are the leaders of the urban development process (Bentley 1999). It is important to note that small and large scale developers are often not involved in the construction of houses. Rather the construction of houses is generally left up to the home purchaser to choose a construction company often put forward by the developer. Although through their financial investment and risk minimisation, developers influence the production of profit-orientated, cost efficient residential developments that usually add to urban sprawl and often do not incorporate sustainable urban design initiatives. Bentley (1999) tries to account for this, arguing that private development organisations work within a 'capital accumulation process', whereby wealth in the form of money is converted into supplies of raw materials and labour to produce a built form to be sold in the market place. The built form is then converted back into money in the market place by way of sales which are reinvested to re-start the process. However, for this process to be profitable the final amount received from sales has to be greater than that with which the process began. This means that many developers are drawn to potential development sites with affordable land prices, close proximity to major transport routes, and availability of service and utilities, and residential design approaches and innovations. These are the factors that seem likely to ensure a return on capital in the speculative market place, whereby the 'sales appeal' will depend on potential purchasers' individual preferences (Bently 1999; Ryan 2006). However, Bentley (1999) adds the developer cannot know what the potential purchasers' preference is in advance and therefore most

developers are attracted to designs that offer a wide and generalised market appeal, such as affordable housing prices, large lots and car orientated suburbs.

In this sense real estate properties can be seen as a 'commodity' or 'product'. Bentley (1999) suggests that this makes it very likely that the potential purchaser will have their future economic preferences in mind. Given that houses last for an average of about a century before they are replaced means that there is a high probability that the original purchaser of any particular property will, at some stage, want to re-sell it. As real estate properties are more expensive than many other commodities, the potential resale value is an important matter and the potential purchaser of a property will be concerned with its economic performance over time: illustrating that private sector developers and consumers alike are affected by economic conditions. To ensure a particular residential development holds its value, developers seek out market signals which are broadcast through the professional media, such as business research or consultancy reports, to identify the types of services and built forms that provide for good investments and those which do not. However, developers will also seek out 'innovations' in the market place, such as in built urban design layout or building design, and incorporate them into their developments to provide a distinction between their 'product' and that of other developers. This creates a unique 'selling point' for their residential developments. Such selling points often focus on imagined 'lifestyle' preferences in relation to amenities, family and community. This is evident in the following marketing advertisement extracts of three residential developments produced by three private development companies in New Zealand and Australia:

> *"Pegasus is a property development like no other: a home for up to 7,000 residents, where lifestyle, fun and entertainment are built into the very fabric of the community". Pegasus, Christchurch, New Zealand: Infinity Investment Group (www.pegasustown.com).*
>
> *"Jordan Springs will be a beautiful master-planned community that will offer the ideal lifestyle for you and your family. Parks, playgrounds, walking and cycling trails, sparkling lakes, sports fields, basket ball and tennis courts, BBQ facilities and landscaped streets will provide a refreshing escape from the bustle of daily life". Jordan Springs, Sydney, Australia: Delfin Lend Lease (www.jordansprings.com.au).*
>
> *"Together with some of Perth's most trusted builders, we pride ourselves in building suburbs where singles, couples and families can live and play amongst friends, conveniently situated close to all the shops you need plus schools for kids, cafes for relaxing and parks for playing. With the very best in community living, Baldivis Central is a really place where you can live your dream". Baldivis Central, Perth, Australia: Australand Property Group (residential.australand.com.au).*

The cost effectiveness of the overall product or 'lifestyle package' is important to developers and can affect the decisions they make on whether to choose one particular built form or development practice over another (Bentley, 1999). Given these suppositions, it would seem probable that if the majority of greenfield/residential developers have the same profit orientated, cost-efficient design approach, and if it is mostly these approaches that determine the built forms of subdivisions or urban developments, then it is no surprise that many sprawling suburbs across New Zealand and Australia look the same and add to the environmental and social disruptions outlined in chapter two. However, in Australasia

indigenous development corporations and government development agencies are also major players in producing urban form. Given their emphasis on protecting and enhancing cultural and public wellbeing, this research will explore the extent to which these two developer typologies produce better quality built outcomes and if they seek different monetary dividends compared to 'normal' private developers.

Indigenous urban development corporations

Although corporate cultural and environmental responsibility has been a topic of many authors' research (Fulmer, Godoy & Neff 2008; Molnar *et al.* 2008; Ketola 2009; Howitt 2010), it is generally discussed in relation to non-indigenous corporations and their exploitation of mining and forestry resources. This research is interested in establishing whether indigenous owned urban development corporations through their cultural and environmental values produce better quality built outcomes. This is not a common topic of research in New Zealand, and internationally. This section will discuss a the biggest development company in the South Island, New Zealand, Ngai Tahu Property Corporation (NTP) to illustrate their cultural and environmental values in order to provide context for the Wigram Skies case study in Chapter Five, which will provide first hand insight to whether their practices are any different to 'normal' developers.

NTP is one of the four commercial companies of Ngai Tahu Holdings Corporation (the others being Nagi Tahu Seafood, Ngai Tahu Tourism and Ngai Tahu Capital) and is predominantly run by New Zealand Europeans. The Corporation is the 'commercial' arm of Te Runanga o Ngai Tahu (assembly of Ngai Tahu), a governing body overseeing the tribe's 18 local runanga activities. It was established under the Te Runanga o Ngai Tahu Act 1996. The 'cultural' arm of Te Runanga o Ngai Tahu functions under the title 'Office of Te Runanaga o Ngai Tahu' and manages the administration, monitoring and delivering of social and cultural programmes on behalf of the iwi (extended kinship group, tribe, nation or people). Te Runanga o Ngai Tahu is a corporate body which manages the assets and businesses of Nagi Tahu and distributes the benefits to individuals comprising the tribal membership of Ngai Tahu. The assets being managed are part of a settlement claim agreement with the Crown established under the Ngai Tahu Claims Settlement Act 1998. The settlement agreement included: $170 million in cash, 55 commercial properties, 54 farms, 27 crown forestry land licences, as well as high country stations and other parcels of land throughout the South Island. In addition, the agreement included 'first right of refusal' whereby Ngai Tahu has the first opportunity to acquire a large range of crown assets when these are being sold. NTP were allocated a portion of this settlement and focus their business objectives on five areas: property investment, property management, property development, rural investment, and managing the tribe's 'first right of refusal' to purchase crown property assets, contributing to a total of approximately $450 million of market value assets.

Thompson-Fawcett (2010) claims that the Maori interpretation of the built urban environment is fundamentally different to that of western conceptualisations and is being employed in both new spheres and ways aimed at actioning sustainable urban development through the increasing

awareness among Maori of traditional environmental and cultural knowledge, values and concepts. Awatere et al. (2010) affirm this and further state that the traditional Maori aspirations and ideals for settlements which were designed to protect and provide for the needs of their inhabitants have not changed. The aspirations and ideals that Awatere et al. (2010) refer to are based on traditional Maori values that have been developed to create 'Maori urban design principles for papakainga' (home or village). These are illustrated in Table 3 below:

Table 3: Maori urban design principles for papakainga development. Source: (Awatere, Rolleston & Pauling 2010)

Principle/Value	Translation/description	Purpose
Kotahitanga	Cohesion and collaboration: collective cooperative and effective partnerships and collaboration with community.	To encourage community unity and identity.
Wairuatanga	Embedded emotion/spirit: emotional connection with the environment that links people.	To maintain and preserve the essence of tangata whenua (local people).
Manaakitanga	Hospitality and security: acceptance and hospitality given to visitors, and protection and security of the community.	To embrace and welcome all peoples, especially visitors, and to provide a safe and secure community environment.
Whanaungatanga	Participation and membership in the community and social setting.	To encourage community participation and pride through building and emphasising community identity.
Kaitiakitanga	Guardianship and stewardship: protection of significant landscape features important to the local community.	To support the protection of important environmental and cultural features through community ownership and collective responsibility.
Rangatiratanga	Leadership, identity and self-determination: communities can lead and take responsibility for creating and determining their own future.	To promote self-determination and independence.
Mauritanga	Essence/life-force: essence of the natural environment.	To identify and promote the maintenance or restoration of mauri (life).
Orangatanga	Health and well-being: maintain health and well-being of the community.	To promote environmental protection and a safe community.

Matauranga	Knowledge and understanding: understanding of community history, identity and character.	To encourage community understanding and pride through shared knowledge.

Yates (2010) explains that these Maori urban design principles assist and support the preservation of culturally significant resources and landscapes, and the building of community identity and participation based on Maori values. Several authors (Awatere, Rolleston & Pauling 2010; Gray & Hoare 2010; Yates 2010) collectively proclaim the development of the Maori urban design principles in establishing a new approach to overcoming the urban challenges presented by urban sprawl and sustainability issues through following traditional designs of the Maori whare (house or building) and pa (villages and towns). The combination of the whare and pa is traditionally designed as a mixed-use, cluster style housing layout which would provide opportunities for habitation, commerce, urban agriculture, renewable energy, water recycling and storm-water remediation via wetlands (Yates 2010).

NTP, who are a major participant in the development of urban form in Christchurch, South Island, New Zealand, share four of these traditional Maori values (Manaakitanga, Whanaungatanga, Kaitiakitanga and Rangatiratanga) and through their corporation can potentially provide an avenue for the practice and development of the Maori urban design principles (www.ngaitahuproperty.co.nz). NTP have six residential developments underway and several that have been completed throughout Christchurch. However, it is not clear through their website whether the 'cultural' arm of Te Runanga o Ngai Tahu influence the built outcomes of NTP's residential developments, even though their values seek to protect and maintain tangata whenua identity. The majority of their residential developments in Christchurch are constructed to 'western' design principles and are carried out on greenfield sites, a 'business as usual' approach. Chapter Two outlined the adverse effects of such development, and coupled with this section raises questions about their role as guardians or stewards of the land - Kaitiakitanga.

Government development agencies

Similar to indigenous development agencies, there is little research information regarding government development agencies and the extent to which their values or governmental visions are represented in their built form outcomes in New Zealand. This section will provide context for the Aurora case study in Chapter Seven which is being developed by a Victorian state development authority, VicUrban. Gleeson and Coiacetto (2005) argue that land market regulation provides a direct role for government in the production of new houses. They state that the conventional planning approach was premised on the notion that government was a regulator of land markets through statutory instruments, such as zoning, to address externalities and provide orderly growth, often referred to as 'negative planning' or 'regulatory development control'. By contrast, the involvement of government development agencies was premised on the government acquiring both property and development rights as a principal means for land market regulation which is characterised as 'positive planning'.

The objectives of government development corporations in Australia are detailed in Box 1 below which seek to provide:

Box 1: objectives of government development agencies. (source: Gleeson and Coiacetto, 2005)

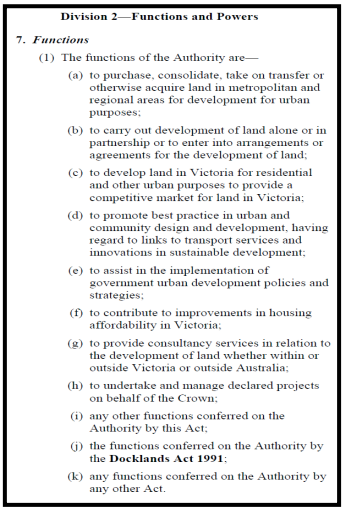
- Better co-ordination of urban development
- More equitable development
- Lower priced land
- Retention of some of the unearned increment in land value
- Better information about the costs of urban development
- More co-operative approach between governments to urban development issues

The basis for the involvement of government urban development corporations revolved around the concern that surplus land increases in value when it is rezoned for urban development and when it becomes closer to social and transport infrastructure providing benefits for private developers through increased land values, but increased cost for consumers (Gleeson & Ciaocetto 2005). Therefore to slow down the rise in land prices government agencies would buy up areas of land deemed for urban development thereby reducing or removing land price increases. In addition, Gleeson and Coiacetto (2005) explain that private property markets and 'negative planning' produced fragmented urban development and infrastructure. This lack of coordination raises the cost of development for developers and council, as well as reducing access for consumers.

The original initiative for public (government) involvement in land development occurred in Australia after World War II with the creation of the National Capital Development Commission. This led to the development of the Land Commission Program (LCP) and subsequently the establishment of Urban Land Commissions (ULC) in five states: New South Wales (1975), South Australia (1973), Western Australia (1975), Tasmania (1975) and Victoria (1975) (Gleeson & Ciaocetto 2005). The purpose of ULCs was to play a leading role in the development of well coordinated State Planning Policy Frameworks, and to acquire land on the fringes of main cities and release land to the private sector to promote innovative development (Gleeson & Ciaocetto 2005). With regards to Victoria, this saw the inception of the Urban Land Authority Act 1979 which established a corporate urban development body, Urban Land Authority, whose purpose was to facilitate the disposal of lands, and provide developed and undeveloped allotments, as well as objectives relating to the construction of infrastructure services and roading. This Act was superseded by the Urban Land Corporation Act 1997 that formed a state owned 'Urban Land Corporation' with the purpose of developing residential land in Victoria. It was amended in 2001 to include regional development and then replaced by the Victorian Urban Development Authority Act 2003 and the establishment of VicUrban.

The functions of VicUrban are detailed in section 7 of the Victorian Urban Development Authority Act 2003 and are shown in Box 2 below, with section 7(2) of the act explaining that these functions are to be carried out on a commercial basis:

Box 2: details the functions of VicUrban



Division 2—Functions and Powers

7. *Functions*

(1) The functions of the Authority are—

(a) to purchase, consolidate, take on transfer or otherwise acquire land in metropolitan and regional areas for development for urban purposes;

(b) to carry out development of land alone or in partnership or to enter into arrangements or agreements for the development of land;

(c) to develop land in Victoria for residential and other urban purposes to provide a competitive market for land in Victoria;

(d) to promote best practice in urban and community design and development, having regard to links to transport services and innovations in sustainable development;

(e) to assist in the implementation of government urban development policies and strategies;

(f) to contribute to improvements in housing affordability in Victoria;

(g) to provide consultancy services in relation to the development of land whether within or outside Victoria or outside Australia;

(h) to undertake and manage declared projects on behalf of the Crown;

(i) any other functions conferred on the Authority by this Act;

(j) the functions conferred on the Authority by the **Docklands Act 1991**;

(k) any functions conferred on the Authority by any other Act.

These functions form the basis of VicUrban's values, although primarily their main 'objectives' are to demonstrate environmental leadership and 'best practice' in all their urban development projects to create sustainable urban form and to influence other developers to adopt a similar approach. VicUrban have sold over 35,000 residential lots in the last 30 years, and according to their website, they currently have fifteen developments that are master-planned in Melbourne, three in regional (rural) Victoria and eleven 'sold-out' residential developments across Victoria. This is evident in **Error! Reference source not found.** showing VicUrban's current developments, thus illustrating their role as a key player in creating urban communities. Even though many of these developments are yet to be completed, VicUrban's environmental leadership can be seen through their urban design and Distributed Water Sensitive Urban Design (DWSUD) approaches at Melbourne Docklands, Tenterfield and Lynbrook, all shown in Figure 7 below. Melbourne Docklands was awarded the 2004 Australia Award for Urban Design and the Planning Institute of Australia (Victorian chapter) Ecological Sustainable Development (ESD) Award in 2003. Tenterfield received three industry awards for landscape and DWSUD works, and Lynbrook was the first residential development to incorporate DWSUD on a large scale in Victoria (www.vicurban.com).

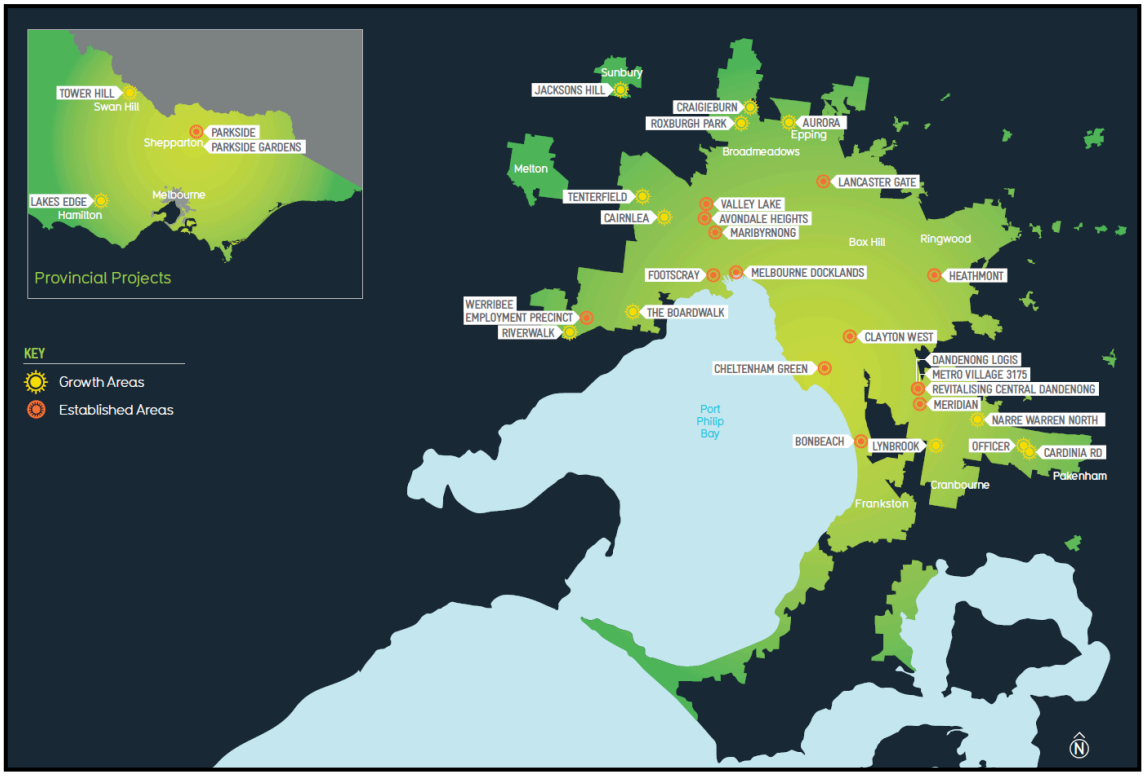


Figure 7: Melbourne's urban boundary and current/recent residential developments. Illustrates VicUrban's growth area, inner city revitalisation and regional projects. Source: (VicUrban 2009: p10)

Other actors

This section will draw on papers from the UK and USA to outline other actors involved in the design phase of residential developments to provide insight to their roles and interactions. Bowman and Thompson (2009), and Dair and Williams (2006) suggest that the actors have the most influence on the design of residential developments are developers, consumers, planners and architects/urban designers. Bentley (1999) clarifies that the various actors involved in planning and designing new urban developments often enter this process at different stages. In the beginning, or the design phase, a developer will employ an architect who has the responsibility of designing buildings, drawing up master-plans, and may also manage the implementation of urban projects. As well as this architects advise on a range of issues, including: sustainable materials, energy efficient design and technologies, and the social and economic impacts of a particular development (Dair & Williams 2006). As indicated above developers work around the cost effectiveness and market attraction of residential developments. If there is little interest in 'sustainable' design features in neighbourhoods or buildings from the consumer then such features will not be seen as a competitive choice in the market by the developer and will not be included in the designs. On top of this, Youngentob and Hostetler (2005) argue that many urban architects cannot succeed in their attempts to create sustainable

communities or promote conservation as they have little understanding of natural environmental processes, leading to poorly designed 'green' communities.

Once the initial design of the proposed development is complete, it is then submitted to the appropriate council authority which is then reviewed by an urban designer and a planner. The urban designer's role is to advise on whether the development is likely to encourage or discourage social interaction, make the best of the climatic conditions, provide a safe environment, and enhance or damage local character. They also judge whether the building design is capable of providing optimal thermal performance and comfort, and whether it will be a positive visual contribution.

The planner's role is to assess the short and long term social and environmental effects of the proposed development in relation to the immediate local surroundings and the wider geographical area advising on it's suitability. However, Bowmand and Thompson (2009) argue that some planners have a lack of knowledge and experience in dealing with 'sustainable' urban developments and that this can lead to poor planning decisions. Dair and Williams (2006) however argue that planners have the responsibility to gain specialist advice and opinions of other actors, such as environmental engineers, with regards to the proposed development, which enables them to up skill themselves. The planner must also take into account the local planning policies and regulations to provide development recommendations, if required, for approval. It is only when developers seek to steer away from regulations, such as changing residential lot sizes to produce higher density 'green' developments, that hinder approval processes (Bowman & Thompson 2009). Various studies (Hostetler *et al.* 2008; Bowman & Thompson 2009; Carter 2009) suggest that the increased cost of the planning process from producing sustainable communities is a common reason for developers' reluctance to accommodate sustainable features. Not only this, Carter (2009) indicates that sustainable communities may be viewed as unfavourable by financial institutions and investors of the development who are also seeking a quick return through risk minimisation.

Various authors (Hostetler *et al.* 2008; Bowman & Thompson 2009; Carter 2009; Hostetler & Noiseux 2010; Noiseux & Hostetler 2010) also suggest that there is a common reluctance from consumers to purchase homes in 'sustainable' communities due to the additional costs brought about by the inclusion of energy efficient technologies and the increased planning costs. It is also indicated that the behaviour and environmental knowledge of purchasers do not change once they have moved into a sustainable home or community contradicting the perception that design, such as in New Urbanist developments, can change peoples behaviour alone. It is suggested by Hostetler et al. (2008) that sustainable behaviours can be managed through structural change in policies that require community management, such as education programmes for new residents or 'covenants' that organize and manage residents' decisions on home maintenance and neighbourhood stewardship. However, this implies a long term commitment to such stewardship which may not be realistic when suburban population turnover is relatively high.

Summary

The ‘networking’ of public and private actors within a statutory framework who influence urban form is conceptualised as ‘urban governance’. It is clear that, although developers direct urban development through profit-orientated, cost minimisation design approaches, the built outcome of urban forms are a product of the relationships, interactions and knowledge base of various actors. The case studies formulated in this thesis draw on the different urban governance configurations outlined in this chapter and exhibit the different environmental problems discussed in Chapter 2, in order to establish the extent to which the case studies represent resilient urban developments. The following chapter outlines a methodology to explore the paradox of sustainable urban development that lies at the heart of this thesis.

Chapter Four: Methodology

Fundamentally this research is concerned with the construction of resilient residential environments and how sustainable forms of water management infrastructure and energy efficient initiatives can be incorporated into residential environments. The key aim is to explore why residential developments follow the status quo when the benefits of incorporating sustainable and resilient forms of urban design are well known. To identify political and institutional barriers to creating sustainable and resilient residential communities, a multiplicity of qualitative approaches and methods of inquiry in attempting to elucidate the interactions and relationships of people involved in the urban development process. Examination of the political processes actors work within will help to identify why residential developments are constructed and designed in ways that do not encourage urban resilience (Winchester 2005).

Ethics and Postionality

This research involved conversing with practitioners and professionals in the areas of their duties or competence to seek non-sensitive factual information about their interactions and relationships with other actors involved in the urban development process, as well as their opinions on the development process itself. This information is not termed private information and does not require ethics approval from the University of Canterbury's Ethics Committee. However, before talking with various actors, informed consent was gained by the researcher and participants were made aware of the aims and objectives of this research and what was expected from them: for example, the time needed to conduct interviews. The research was approved by the Head of Department, Geography, University of Canterbury.

In terms of positionality, the researcher has been driven by a desire to understand the barriers to constructing resilient residential communities and the urban governance system in New Zealand and Australia so that knowledge gained can be carried over into 'real world' situations. It is understood by the researcher that knowledge does not exist independently but is rather partial, geographically and temporally located (Mansvelt & Berg 2005). As well as this the researcher recognises that the social, cultural and subject position, or subjectivity, in turn affects the questions asked, how the questions are framed, how the research is conducted, what literature is reviewed, and how the literature and resulting data are interpreted, and that it is important to critically reflect on the research literature and data to understand the power relations and structures within the urban governance system (Pratt 2009). The researcher has been granted a Master's Scholarship from the New Zealand Centre for Sustainable Cities and, although not directly, has been influenced by their interests in sustainable urban development. As well as this the researcher recognises that the shared knowledge of

supervisors and research colleagues also influences the conducting of the research, interpretation of research data and study site options.

Case Study Research

Qualitative research seeks to understand the way people experience similar events, places and processes differently as part of a fluid reality (McGuirk & O'Neill 2005). Qualitative methods focus on 'what people tell you' and 'what they do' in order to gain an understanding of 'what is going on' (Gillham 2000). Herbert (2010) suggests that people's actions are structured by place, or place structures social activity, and that place exerts power that influences human actions that have the capacity to define a particular space. Case studies are often used to better understand such actions and directly resolve problems through identifying phenomena that occur in places in order to generate or expand urban theories (Baxter 2010). A case study can be applied to individuals, groups or community research, and through a collection of multiple forms of evidence can provide useful insight to the processes and structures within particular places or spaces, as well as how various actors are represented and how they represent themselves (Bradshaw & Stratford 2005). In light of this case study analysis was adopted as the main method of enquiry to understanding and conducting this investigation on development activities and social processes in the urban environment (Baxter 2010).

There are criticisms of case study analysis, such as those of Flyvbjerg (2006). He presents a common misconception about case studies in that they have a lack of generalisability as they are usually based on one or a small number of cases. Baxter (2010) however insists that a case study can provide in-depth 'generalisability' if it is well designed and analysis is attentive to the tensions between abstract and concrete concepts. Moreover, he considers generalisability as a term used by quantitative social scientists. Qualitative social scientists on the other hand prefer the term 'transferability', which refers to the extent to which research findings in one case apply to other cases of the same phenomenon (Baxter 2010). In other words, rather than attempting to find one 'dominant' or 'correct' interpretation, the case study approach applied in this research will emphasise multiple meanings, interpretations and experiences of actors involved in urban governance as part of the multifaceted fluid reality of the urban environment (Winchester & Rofe 2010). This research will use multiple case studies to provide a broader basis for exploring theoretical concepts and explanations of urban sprawl and urban governance as a way of overcoming this limitation and to strengthen case study research in the social sciences.

The first case study, Wigram Skies, Christchurch, New Zealand, was selected because it is being developed by a New Zealand indigenous development organisation, Ngai Tahu Property (NTP), which is one of the South Island's largest property developers. NTP largely invests in greenfield development opportunities throughout Christchurch, and Wigram Skies has been selected to provide insight into an indigenous development corporation's values and development practices. In addition, NTP employed an Australian architecture and design firm, Woods Bagot, to plan Wigram Skies. This company (www.woodsbagot.com) primarily designs and plans larger building developments, such as

universities and high rise complexes. In a preliminary discussion with an NTP development manager, Alan Grove, it was expressed to the researcher that Australia was somewhat ahead of New Zealand in terms of sustainable urban development: hence, NTP's choice to employ Woods Bagot. This also sparked an interest in investigating the differences between New Zealand and Australian development practices.

This discussion then led to the selection of the second site, Aurora, Melbourne, Australia, which was an example provided to the researcher by Alan Grove, who talked of its high sustainability standards in regards to energy efficiency and water management. Aurora is a state-owned development site and is being developed by VicUrban, a Victorian State owned development agency, which provides a useful contrast to NTP. As well as providing an international comparison, the researcher was interested in examining the view that Australia was ahead of New Zealand in terms of sustainable urban development and if so, what differences exist in the urban governance configurations in Australia that influence better built outcomes.

The third case study, Kirimoko, Wanaka, New Zealand, was a development provided to the researcher by a fellow Masters student, Timothy Walsh, who had been a planner in Queenstown. Kirimoko is attempting to achieve high sustainability standards through a non-traditional subdivision approach that centres around a landscape, storm-water design, even though its developer, John May, is not required to do so by the resource management system. These three sites provide interesting comparisons in spatial scales, density, design approaches and developer typologies and how their values are translated into the built outcome of the urban form. A brief site description of each residential project is detailed in Table 4 below:

Table 4: Study Site Description

Developer	Site name and location	Size (hectares)	Dwellings
NTP	Wigram Skies, Chrsitchurch	153ha	1700
John May	Kirimoko, Wanaka	11.86ha	51
VicUrban	Aurora, City of Whittlesea, Melbourne	592ha	8,000

Winchester and Rofe (2010) explain that qualitative research is concerned either with social structures or with actor experiences, whereby the behaviour and experiences of actors may be shaped by their position in the social (or institutional or political) structure, together with their associated resources, constraints or rules, rather than by their personal characteristics alone. Therefore, to add substance to the case studies interviewing was adopted to provide in-depth knowledge of the various actors' opinions, beliefs, experiences, behaviours, motivations and awareness in relation to sustainable urban development and development practices in New Zealand

and Australia. Interviewing is a spoken exchange of questions and information. Dunn (2010) suggests that interview questions can be structured in three ways: structured, unstructured or semi-structured. These three methods are outlined in Table 5 below:

Table 5: Interview methods (after Dunn 2010)

Interview method	Method description
Structured	Interview follows a predetermined and standardised set of questions, often laid out in a schedule
Semi-structured	Interview follows a degree of predetermined set of questions, but maintains flexibility in the way the respondent can address issues
Unstructured	Interview is respondent driven and has no predetermined order to issues. The researcher will raise questions appropriate to the respondent's previous comment. It is used most to gain 'oral histories'

This research adopted semi-structured interviews generally consisting of around ten open-ended questions, which allowed the researcher to probe on certain topics of interest that were raised during the interview process. In addition, questions were added, removed or altered depending on the practitioner being interviewed, eg architect, developer or planner. This was appropriate due to actors having different roles in the development process and therefore requiring somewhat different questions that related to their field of expertise. Interview questions related to:

- Actor's roles and responsibilities in the development process
- Actor interactions, relationships and conflicts of interest
- Interpretations of sustainable urban development
- Perceived barriers to sustainable residential development, sustainable water management, and the adoption of energy efficient design and technologies
- Comparisons between New Zealand and Australian development practices
- New Zealand resource management system
- Australian/Victorian planning system
- Consumer preferences and marketability

A hybrid concept of adopting 'funnelling' and 'pyramid' structures was applied to order questions during the interviews. This process required general questions, say about the actor's roles and duties,

to be asked first then gradually moving towards questions that were more focussed on the research aims and objectives (Dunn 2010). This allowed the researcher to build a rapport with the respondent during interviews and reduce any apprehension the respondent might be feeling when asked questions that may be of a sensitive nature.

As mentioned earlier, a preliminary discussion with an NTP developer, Alan Grove, took place before the official start date of this research. It was hoped that this discussion would lead into a series of interviews with NTP's development team to explore indigenous urban development practices, as well as investigating the dynamics between NTP (business) and Te Runanga Ngai Tahu (cultural) arms of Ngai Tahu. Even though the first meeting with Alan Grove was positive, it was subsequently explained that no more contact could be made with regards to Wigram Skies due to 'commercial sensitivities'. After some careful persuasion Alan Grove answered a few questions via email. Contact was also established with Tony Sewell, Chief Executive of NTP, who was more than happy to discuss development practices and NTP's role in urban development in Christchurch. Gaining evidence from the cultural side of Ngai Tahu proved equally difficult. It was not until the last two months of the research that contact was made with Te Marino Lenihan, Ngai Tahu Cultural Advisor for Urban Developments, who had extensive knowledge about Ngai Tahu values, and how to incorporate these into urban developments.

The various other respondents were identified through contacting actors at the relevant councils where the development projects are located. For example to identify actors involved with the Aurora development, which is in Whittlesea, Melbourne, a general enquiry was made via the City of Whittlesea (local council) website which was then forwarded to appropriate actors within the council who were involved in the planning of Aurora. The council actors then provided information or leads to identify potential respondents outside the council, such as private planners, engineers, architects or developers. Surveying residents of the development sites was considered, although only Aurora had stages completed with residents living there. It was decided that real estate agents would provide a good perspective of the consumer or the market. However, due to a lack of reply/willingness from agencies in all three centres, only one real estate agent based in Christchurch, Peter Cook, was interviewed.

Actors were initially contacted via email with a description of the research aims, its objectives and significance. Once contact was made and potential respondents agreed to be interviewed, meeting dates and times were set up which were generally conducted at the actor's place of work. Interviews were recorded using a dictaphone with the permission of the respondent: one actor did not wish to be recorded and one did not wish to be named. Interviews were then transcribed by the researcher on the same day of the interview. Any pictures that the informant used to illustrate his/her points of discussion were also drawn by the researcher on a separate piece of paper which was then inserted into the transcribed text. Some actors, however, had various commitments at the time the researcher was collecting data, and therefore two interviews were conducted via a relay of emails. As well as this, one interview was conducted via Skype, an internet video calling service. This was recorded and transcribed. A total of 17 interviews were conducted. They generally lasted for about 30-60 minutes.

The full list of interviewees provided in Table 6 below are ordered according to the development site they were/are involved in. Some respondents were not involved in any of the three development sites but were seen to have extensive knowledge and/or experience in urban development practices, renewable energies, water management and urban governance. They are listed towards the bottom of the table. Throughout the case study analysis respondents will be referenced as 'pers. comm.' (personal communication).

***Table 6*: Actor interview respondents**

Actor	Position	Affiliated organisation/company	Associated development site/s	Date of interview
Tony Sewell	Chief Executive	NTP	Wigram Skies	November 22, 2010
Alan Grove	Developer	NTP	Wigram Skies	February 19, 2010
Te Marino Lenihan	Cultural urban advisor	Ngai Tahu	NTP	February 22, 2011
Scott Blair	Council Planner	Christchurch City Council	Wigram Skies	July 19, 2010
Hugh Nicholson	Urban designer	Christchurch City Council	Wigram Skies	July 20, 2010
Mark Pennington	Environmental Engineer	Pattle Delemore Partners	Wigram Skies/Kirimoko	October 8, 2010
John May	Environmental Developer	Crescent Investments Ltd	Kirimoko	September 13, 2010
Simon Magri	Developer	VicUrban	Aurora	August 27, 2010
Rhys Loughran	Council Planner	City of Whittlesea	Aurora	August 25, 2010
Frank Hanson	Urban Designer	City of Whittlesea	Aurora	August 25, 2010
Paul Mitchell	Development Engineer	City of Whittlesea	Aurora	August 26, 2010
Tony More	Policy Advisor Sustainability	Christchurch City Council		July 19, 2010
Jenny Ridgen	Programme Manger Healthy Physical Environment	Christchurch City Council		July 22, 2010
Council Respondent	Policy and Projects	City of Whittlesea		August 26, 2010
Alister Gardner	Engineer: Manager, Distributed and Hydrogen Energy Team	Industrial Research Limited		February 12, 2011
Graeme McIndoe	Urban Designer	McIndoe Urban		29 July, 2010
Peter Cook	Real Estate Agent	Simes		July 23, 2010

and Evaluator

Focus Groups

Focus groups were also used as another method of inquiry. They are an effective approach to gaining information about the multiple meanings people attribute to places, relationships, processes, and how events are expressed and negotiated (Cameron 2005). The interaction between group members is a key characteristic of focus groups where people respond not only to topics introduced by the facilitator but more importantly to the contributions of other group members (Cameron 2005). Focus groups were employed as it was believed that actors participating in such a group would be more willing and comfortable in expressing opinions relating to urban governance and development practices. Two focus groups were conducted: one with staff from Queenstown Lakes District Council and one with Resource Management Group, private planning consultants based in Christchurch. They are illustrated in Table 7 below:

***Table 7*: Focus group participants**

Actor roles and number of participants	Affiliated organisation/company	Associated development	Date of focus group
Private planners (5)	Resource Management Group	Various developments around Christchurch	September 24, 2010
Various council staff: urban designers, planners, engineers and policy planners (22)	Queenstown Lakes District Council	Various developments around the Queenstown and Wanaka region, including, Kirimoko	August 3, 2010

The focus group questions were similar to those employed in the interviews. They were arranged through a semi-structured format. The QLDC focus group was conducted to explore issues regarding the Kirimoko development and urban development in Queenstown/Wanaka generally. The QLDC focus group did not follow the usual requirements. It was held in conjunction with a meeting for QLDC employees and meant that there were 22 people present: typically focus groups should have about 6-10 people. The actors at this focus group ranged from urban designers to policy analysts to planners. In addition, the time allocated to the researcher, 20 minutes, was not adequate to stimulate conversation and interaction amongst the group, and follow the predetermined topics of conversation: usually an hour or more is necessary. This meant that half the questions were omitted and only those relating to perceived barriers to sustainable urban development and opinions on the New Zealand's

resource management system were talked about. A 'focus exercise', which is a short questionnaire of about five questions that is carried out before the focus group begins to engage or 'focus' participants on possible topics that may arise, was adopted to ensure that information was gathered from all informants. This did not produce significant results. However even though the focus group was short and involved too many participants, it did produce useful and valuable information.

The focus group conducted with private planning consultants from RMG focussed on topics relating to actor relationships and interactions, the New Zealand urban governance system (past and present), and barriers to creating sustainable urban developments. RMG specialises in assisting clients (developers) through the RMA approval process. This includes: scoping of RMA issues for development proposals, formulating environmental effects assessments, resource consent preparation and lodgement, evidence preparation and hearing attendance, preparation of Environment Court appeals and references, expert witnesses at Environment Court, project management of the resource consent process, consultation and community effects assessments, district and regional plan assessment and policy analysis, and submissions on plans and resource consent applications. The focus group was conducted in the RMG offices with five planners present and lasted for just over an hour. The focus exercise used in the QLDC focus group was not used in the RMG focus group as it was felt that the information gained by the exercise was not useful and could easily be gained during the focus group. The RMG focus group was highly interactive with all participants expressing their opinions at some point during the process.

Observational Research and Field Trips

Observational research was also carried out at all three study sites. The rationale for observational research is to gather additional information on the places of interest through taking notes on the appearance of places, such as houses, roads and gardens (Kearns 2005). Observational research can give added value, or contrast with, what actors express when being interviewed. However, the construction stage at Wigram Skies and Kirimoko had not started and little evidence other than that on sites could be extracted on those fieldtrips.

However on the Kirimoko fieldtrip the researcher had the opportunity to sit in on the consent hearing for the Kirimoko development. This gave first hand insight to the interactions between the applicant (developer), council members and the people who opposed the development during a consent hearing. In addition, attending the consent hearing provided lengthy narratives and presentations from all actors involved in the Kirimoko development which will be used in the case study analysis. Narratives were hand recorded, although written documents containing all actors' presentations were acquired at the consent hearing. The Kirimoko actor narratives that will be used in the case study analysis are detailed in below.

Table 8: Kirimoko actor consent hearing presentations

Actor	Position and affiliated organisatiion	Date of presentation

John May	Environmental developer, Crescent Investments	August 4, 2010
Nicole Lauenstein	Architect, A+rchitecture	August 4, 2010
Ralf Kruger	Landscape architect, Morgan and Pollard Associates	August 4, 2010

In addition, soft copy development plans of Kirimoko were supplied from John May. Area plans and district strategies were also acquired from the QLDC website and will be used in the Kirimoko case study analysis. Interviews in Australia were conducted with actors involved with Aurora as illustrated in Table 6 above. During the fieldtrip a site visit was guided by Rhys Loughran and hard copies of the Aurora Development Plans were provided to the researcher which will also be used in the case study analysis. In addition, Victorian state and municipal government websites provided growth strategies, area plans and local demographic information. No hard copy development plans of Wigram Skies were obtained, although through the NTP website information was gathered regarding the Wigram Skies development. As well as this growth strategies and area plans were gained from the CCC website to contribute to the Wigram Skies case study analysis.

This chapter has outlined the range of qualitative research methods used to explore the paradox of sustainable urban development in Australasia. The purpose of the next three chapters is to outline the three development projects in order to assess the extent to which they experience such challenges identified in chapters 2 and 3. Each individual case study will follow a similar format, although the content of each is appropriate to the story being told in each case.

Chapter Five: Case Study - Wigram Skies

Wigram Skies, Christchurch, New Zealand, is located on a greenfield area of land formally known as 'Wigram Aerodrome', one of the birth places of aviation in New Zealand (The Press 2008a). It is being produced by the largest property development company in the South Island, New Zealand, Nagi Tahu Property (NTP). Wigram Skies has been designed for NTP by a well known Australian architecture and design firm, Woods Bagot, who produced an "innovative and imaginative master plan" around "[g]reen spaces, ease of living, and encouraging a healthy community" through a carefully thought out street and walkway layout to "keep car speed down and encourage residents to bike and walk" (www.wigramskies.co.nz (a)). Wigram Skies is located within the rapidly growing south-western fringe of Christchurch and is described as being NTP's "creation of a vibrant community...setting the standard for modern, innovative and convenient living" (www.wigramskies.co.nz (b)). Wigram Skies takes up 153ha of land and will accommodate 1700 dwellings and approximately 4,000 people. This case study will explore the extent to which NTP's 'vision' steers away from 'standard' residential development design. It will also assess the extent to which the urban governance system in Christchurch reproduces the paradox of sustainable urban development. This will be done through focussing on the extent to which actors and urban governance processes influence the implementation of sustainable water management initiatives and energy efficient design and technology.

Christchurch Growth Pressures.

The Christchurch region, shown in Figure 8 below, is one of four main centres in New Zealand, the others being Auckland, Wellington and Dunedin. Christchurch is the largest urbanised region in the South Island encompassing an area of 1426 sq kms (CCC 2007). It is regulated by Environment Canterbury (ECan) a regional authority and Christchurch City Council (CCC) a territorial authority. Christchurch is expected to grow in population from 413,500 to 548,520 by 2041 as a result of natural increase and migration activities from other areas of New Zealand and overseas. Accompanying this, an increase in new houses from 164,100 to 238,910 is also expected (CCC 2007).

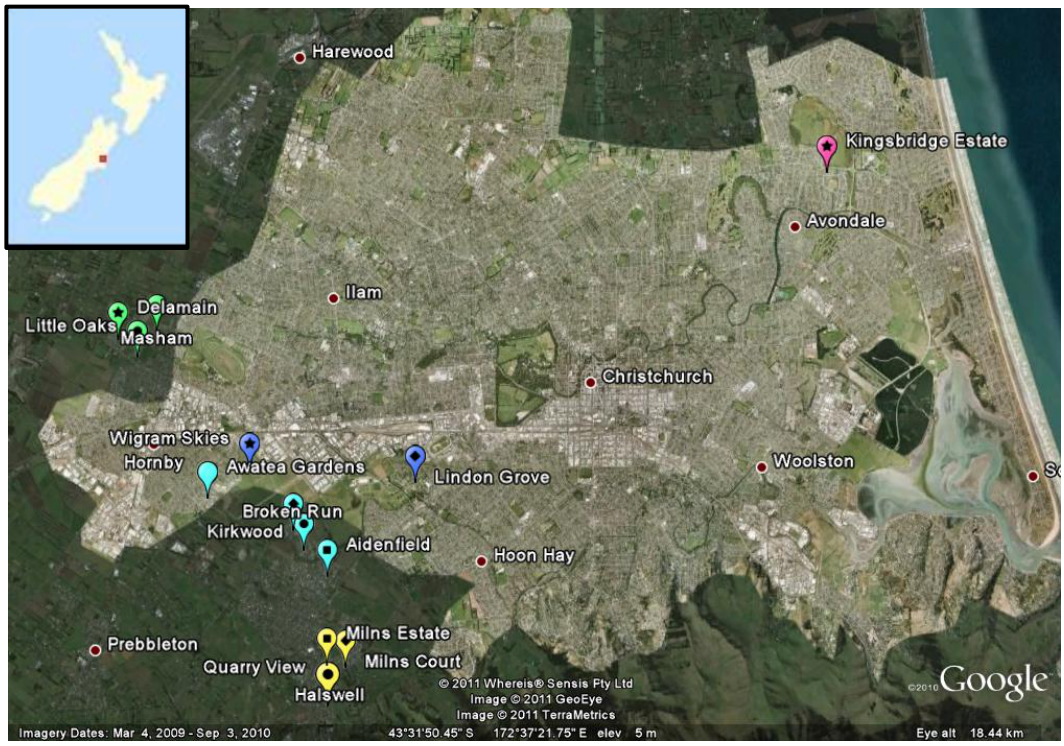


Figure 8: Christchurch urban boundary and current/recent residential developments. The blue star marker shows the approximate development location of Wigram Skies. The other coloured markers show recent development activity in Christchurch illustrating the significance of the south-west as an expanding part of Christchurch.

CCC's Urban Development Strategy (UDS) sets out a long term growth plan for urban development in Christchurch. It sets out a framework of strategies and policies to manage and guide urban development. The UDS recognises that the current sprawling urban growth of Christchurch has reduced intra-urban mobility and connectivity between living and working places, and increased the travelling time and distances between them: providing an example of a shift from time-space convergence to time-space divergence. Increasing urban development has placed pressure on maintaining the quality of groundwater suitable for human consumption without treatment and surface water management. This is especially an issue in the south-western side of Christchurch which encompasses the Heathcote and Halswell River catchments, as well as being located above a confined aquifer in which much of Christchurch's untreated drinking water is supplied (Golder Associates Ltd 2008). However, infrastructure for water supply, as well as the disposal of storm-water and waste-water, is expensive and requires a high level of innovation and coordination for management and implementation. In addition, the cost of electricity and the security of supply are increasing concerns for domestic and industrial users. As development and population growth continues so does the demand for power, including power and energy generated from non-renewable sources. As well as infrastructural challenges, climate change has been documented as an urban challenge in the UDS, although only with regard to coastal inundation and coastal storm surges. However, the CCC's "Climate smart Strategy 2012-2025 sets the direction for community and Council actions that respond to issues and harness opportunities presented by Climate Change" (CCC 2010a: p2). It sets a vision for Christchurch where "[p]eople and communities actively work towards a climate

smart Christchurch that reduces its greenhouse gas emissions and is resilient to the social, cultural, economic and environmental effects of climate change" through a series of goals, objectives and targets (CCC 2010a: p3).

ECan's Proposed Plan Change 1 of the Regional Policy Statement 1998 (RPS) has been devised to give effect to the UDS. A RPS sets the framework for resource management. Proposed Plan Change 1 summarises the main urban growth issues for Christchurch:

> *"The resulting urban form places heavy reliance on road transport, particularly private motor vehicles for personal transportation, which is inappropriate for ensuring the wellbeing of people and communities in the future because of:*
>
> *(a) The changing demographic structure of the population, which will see an increasing percentage of the population in the older age groups, and thus result in a changing pattern of demand for housing and transport modes.*
>
> *(b) Uncertainty about the availability and/or cost of fossil fuels which calls into question the feasibility of the present high level of reliance on private motor vehicles, particularly for day to day use.*
>
> *(c) The need to reduce carbon emissions in line with international commitments. The reduction in the levels of private motor vehicle use is one of the main ways in which people in the Greater Christchurch sub-region can reduce the impacts of global warming.*
>
> *(d) The increased cost of developing and maintaining the transport system" (Environment Canterbury 2007: p2).*

The south-western part of Christchurch shown in Figure 9 below is an area largely zoned as rural land-use and has been identified as one of the main areas to accommodate future urban expansion due the availability of land and connections to other centres, such as, Rolleston, Selwyn and Lincoln (CCC 2007). This is also evident in Figure 8 above which shows various residential developments in this the south-west that have been completed or are under construction. In addition, recent earthquakes in Christchurch on Septemeber 4th 2010 (7.1 on the Richter scale) and February 22nd 2011 (6.3 on the Richter scale) have resulted in wide spread liquefaction in large areas of eastern Christchurch rendering these unsuitable for residential living and development. This could result in a large portion of the potential relocation of 10,000 homes to be accommodated by the south-western parts of Christchurch (Hartevelt 2011). The south-west has a population of approximately 35,000 people living in 13,000 homes. This is expected to grow to approximately 65,000 and 25,000, respectively, by 2041, and quite possibly more given recent events (CCC 2009). The south-west area's population has grown faster than the rest of Christchurch and this is expected to continue, coupled with a reduction in average household size, from 2.9 to 2.6, ageing population and a growing ethnic diversity (CCC 2009). The redevelopment of the Wigram site will help to meet the expected demand for residential housing and has a geographic advantage of being positioned close to significant employment, entertainment and shopping opportunities, as well as recreational facilities and community services from surrounding suburbs, such as Riccarton, Sockburn and Hornby (CCC 2007,2009).

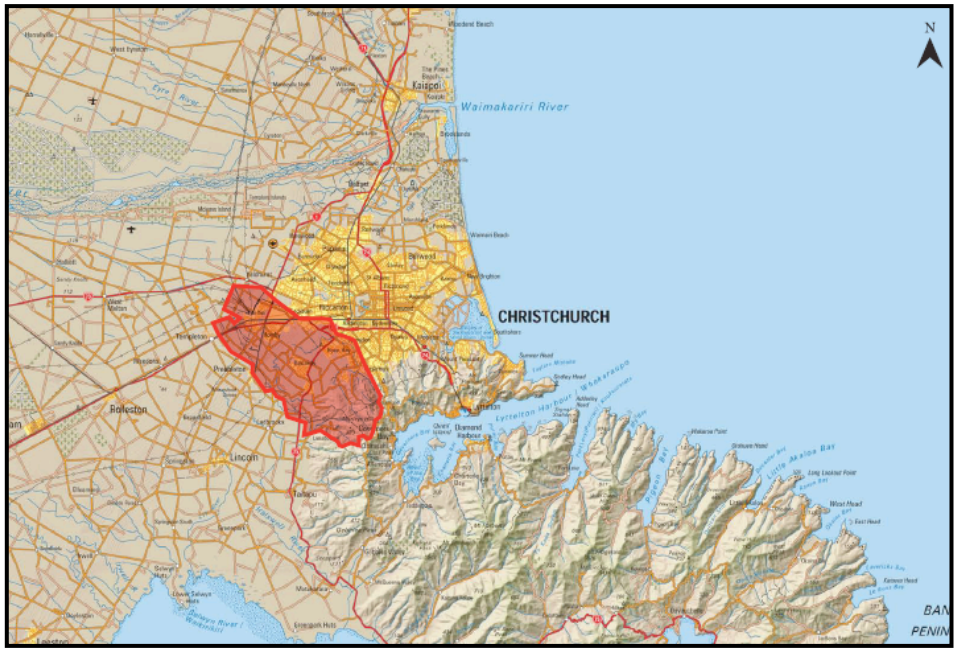


Figure 9: The south-west area of Christchurch and expected urban growth. Source (Golder Associates Ltd 2008).

Planning Wigram Skies

Before the arrival of European settlers, the area now known as Wigram, shown in Figure 10 below, was a hunting ground for local Ngai Tahu. Upon European settlement it became a site for horse racing (trots and gallops) and organised hare hunts, and was named 'Plumpton Park'. In 1916, the Canterbury Aviation Company was formed by Sir Henry Wigram, a successful Christchurch businessman and Mayor at the time, and land was purchased to form 'Sockburn Airport'. In 1923 the New Zealand Government took over control of Sockburn Airport to convert it to a military base, renaming it 'Wigram Aerodrome'. In 1995, Wigram Aerodrome was closed to air force training and in 2009 to commercial traffic due to the Ngai Tahu treaty settlement in 1998, outlined in Chapter Three. The historic significance of this site resulted in minor controversy over whether to redevelop the area or to save and protect the historic airfield. A 3000 strong petition supported the latter, with local residents claiming NTP had carried out minimal consultation regarding their plans for housing development (The Press 2008b). Wigram Skies is located on a greenfield area of land and required a 'Private Plan Change' to rezone the area for residential use. In the formulation of this plan change, development professionals have to take into account the RMA, RPS, and local district and area plans. This includes the Christchurch City Plan (CCP), the South-West Area Plan (SWAP) and the Integrated Catchment Management Plan (ICMP). The CCP is the primary mechanism for the sustainable management purposes of the RMA and outlines development zones, objectives and policies. The SWAP is an 'implementation method' for the UDS and CCP. It consists of a framework for the land-use planning and expenditure in the south-western area of Christchurch. The ICMP is a foundation document to the SWAP and details how surface water management should respond to any future land-use changes.

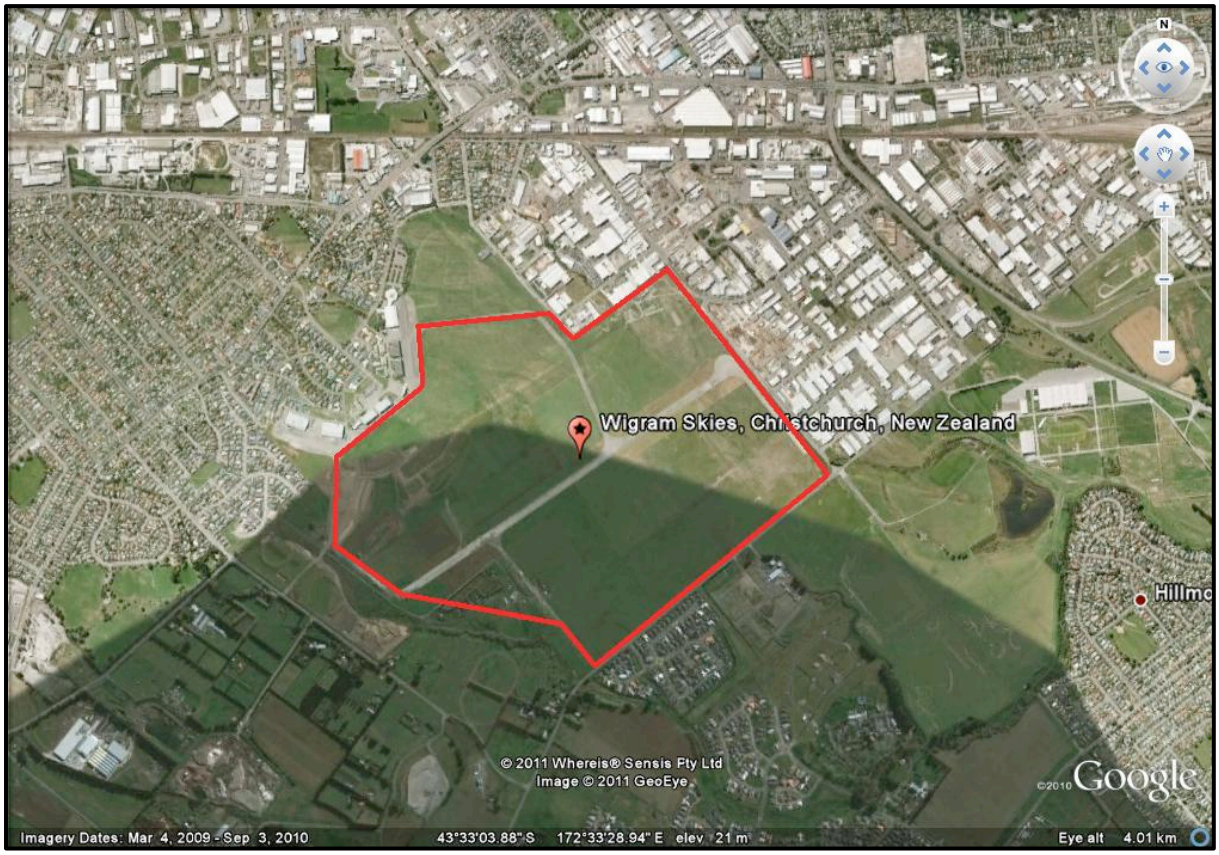


Figure 10: The approximate greenfield area to be converted into 'Wigram Skies'.

Private Plan Change

The land area of Wigram Skies was originally zoned 'Special Purpose (Wigram)', this purpose being to "encourage and enable the maximum utilisation of the existing aviation activities and airfield facilities, as well as the opportunity for further development or redevelopment of an area of the site for business activities" (CCC 2010c: p2). Given the expected expansion of the south-west of Christchurch this area and accompanied zoning was identified by NTP's planning consultants as being inappropriate in terms of its longer-term use (CCC 2010c). Therefore a 'Private Plan Change' was required to rezone this area to fit with the visions of the developer. A Private Plan Change is promulgated under section 73(2) of the RMA to amend city plans, in this case the CCP. Subsequently, Wigram Skies (Private Plan Change 62) is proposed to be zoned 'Living G (Wigram), Business 4 and Conservation 3 zones' facilitating NTP's vision of a mixed-use community.

'Living G' is the CCC's approach to managing the effects associated with greenfield subdivision. This was a product of an Environment Court case on a greenfield growth area in the south-west of Christchurch known as 'Masham', shown in Figure 8. Scott Blair, a CCC Senior Policy Planner, explained in a personal interview that the Plan Change for Masham was guided by urban design material, policy statements, plan rules, an Outline Development Plan (ODP) and layer diagrams. This supporting evidence was not incorporated directly into the Plan Change, but rather was integrated into the CCP as a Living G Zone to guide future greenfield growth areas. He added that the previous approach to urban development was very 'simplistic', where the council would identify an area and

have a diagram showing the major road network and storm-water detention areas. The rest of the subdivision design would be left to the landowners and the rules within the City Plan (the Subdivision Rules), which produced a mixed variety of outcomes:

> *"have a look at say, Aidenfield [indicated Figure 8], which was developed under the more simplistic outline development plans. You'll find an area that is reasonably generic in its density and its allotment sizes and its a little bit confusing in its road layout and some less than optimal green-space or open-space areas. But having said that, there are also some very good parts and well designed parts of Aidenfield, so its a bit of a mixed bag in terms of outcomes" (S. Blair, pers. comm., July 19, 2010).*

The Living G zone "offers the opportunity to plan and develop a mixed density and mixed use residential neighbourhood in an integrated and comprehensive way, allowing a flexible response to the treatment of the urban/rural interface" (CCC 2010b). The Purpose of the Living G zone is to "allow maximum flexibility and incentive for developing the zone for (primarily) residential activity within the framework of four documents": an Outline Development Plan (which shows the different development activities in a zoned area), green (green-space) network layer diagram, blue (water) network layer diagram, and a movement (road) network layer diagram (CCC 2010b). In addition, the ODP package is supported by policy statements and Plan Rules that sit together to comprehensively plan a greenfield growth area. It is achieved through the coordination between developers and the council who detail the storm-water network, transportation network, and green and open space network to maximise better quality outcomes (S. Blair, pers comm, July 19, 2010). Defined in Plan Change 62, Living G (Wigram) will provide for a comprehensive and integrated mixed-use urban community with primary emphasis on urban consolidation and sustainable development.

Business 4 (Suburban Industrial) zones, which can be seen in Figure 11 below, consist of light industrial and service based outlets generally located within or adjoining suburban locations (CCC 2010b). The Christchurch City Plan outlines the zone's purpose to provide for light industry, warehousing, service industries and some commercial activities, such as offices. In addition, some retailing is provided for in these areas with an emphasis on the nature and scale of retail activities not leading to significant adverse effects on the amenity and function of the Central City and District centres. The zone is subject to standards which exclude or control activities where the levels of adverse effects would be detrimental to adjoining living zones and other sensitive zones (CCC 2010c). These standards relate to the effects of amenity values and urban form, such as shading from tall buildings, domination of built form, contrast with the suburban built environment, disruption of view-shafts, noise levels, setbacks and height standards. Business 1 zoning, which is also proposed in Wigram Skies, are defined by the City Plan as small scale retail shops and service activities, often characterised by 'strip' development of shops adjoining road frontages. The purpose of these zones are to provide local opportunities for employment, community activities and convenient access to goods and services (CCC 2010b).

The Conservation zones specified in the CCP include diverse areas of scenic, ecological or heritage significance, which are sensitive to modification or intensive public use. Conservation 3 zones include the surface of waterways and their margins, and some minor waterways and areas within other

conservation and open-space zones. Land within this zone has moderate to high ecological and/or cultural value and contributes to the identity and character of the area. The CCP sets out zone provisions that take into account the ecological and cultural values of the waterways, the surrounding land activities, the desirability of public access to and along waterways, and the varying levels of public use of waterways. The Conservation 3 zones at Wigram, shown in Figure 11 below, will incorporate storm-water management functions and will provide enhanced alignment of the Heathcote River and the construction of the Awatea Storm-water basin, which is a sub-catchment next to the sub-catchment of Wigram.

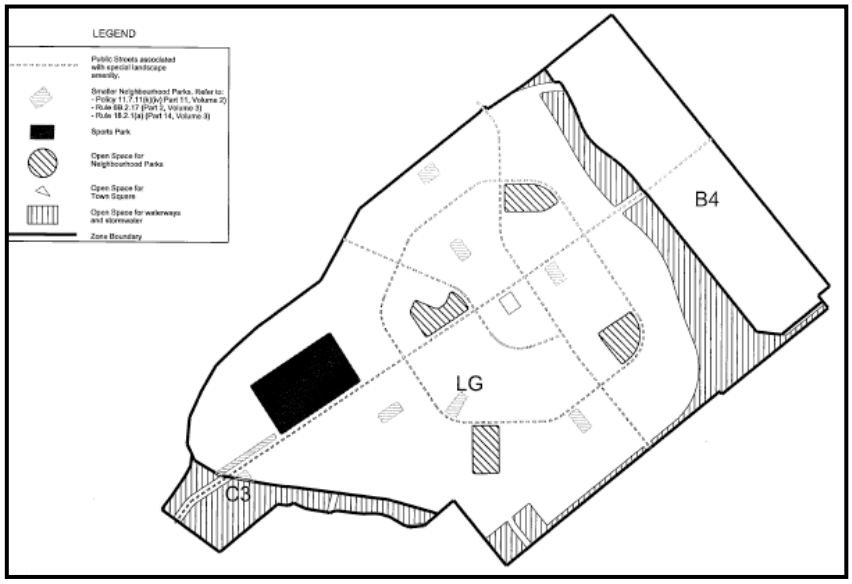


Figure 11: Wigram Skies' zoning arrangement. Business 4 Zone (B4), Conservation 3 Zone (C3) and the residential Living G Zone (LG). This also illustrates the C3 zones and related storm-water networks and green-spaces that will be talked about below. Source: (CCC 2010c).

To reflect the objectives of the CCP, Proposed Plan Change 1 of the RPS and the South-West Area Plan (SWAP), Wigram Skies was designed to accommodate a higher residential density, or mixed-use density, compared to traditional low-density greenfield developments that were zoned before the conception of 'Living G'. NTP engaged Woods Bagot, an Australian Architecture and Design Firm which was first launched in 1869 by Edward Woods in Adelaide. It has a network of architecture, design and planning specialists working across five regions: Australia, Asia, Europe, the Middle East and North America (www.woodsbagot.com). It is evident on the Woods Bagot website that they have a focus on sustainable urban design, as many of their developments have achieved 5 or 6 star green rated status. However, many of their developments are large facilities or high rise developments such as universities or apartment buildings, rather than mixed-use residential design. Woods Bagot collaborated with CCC planners to gain an understanding of how Living G works and the expected outcomes, such as mixed densities, provision of local convenience retail, and how open-spaces can be collocated with the storm-water networks (S. Blair, pers comm, July 19, 2010). As a result, Woods Bagot designed three areas of density at Wigram Skies which are shown in Figure 12 below. 'A' is equivalent to Living 3 (L3) or high density; 'B' is transitional density, or medium density, that provides

a buffer zone from the town centre to 'C', which is equivalent to Living 1 (L1) or low density (S. Blair, pers comm, July 19, 2010). The 'ATC' zone, also shown in Figure 12, town centre, encompasses buildings with additional height to reinforce the town centre as a focal point for the community, which will provide additional local shopping, entertainment, and community and service uses (CCC 2010c).

Figure 12: Master Plan of Wigram Skies.
Prepared by Woods Bagot this map illustrates the density areas of Wigram Skies. Source: (www.wogramskies.co.nz (a)).

During the design of the master-plan, S. Blair explained in an interview that the CCC raised concerns over the ATC density. The CCC were concerned about what type of commercial retail should be present so that it does not draw economic spend from other retail catchments. In addition, the CCC sought to create a condition that enables them to take a finer look at the design details of the buildings in this area, such as building heights, character, outdoor living spaces, and their relation to the streetscape and neighbours before construction occurs. S. Blair reported that the idea was not favoured by NTP:

> *"Ngai Tahu Property have a different view, they believe that those rules are not required due to the comprehensive design that they have already done for the area, and I guess we will be exploring that over the next few months. Its unclear whether or not that these particular urban design rules will end up in a package eventually but hopefully they will and we will continue negotiations with those" (S. Blair, pers comm, July 19, 2010).*

This illustrates the power relations between developers and council in terms of design objectives. It is an example of what Graeme McIndoe, Architect for McIndoe Urban and professor at Victoria

University, Wellington, terms 'silo thinking'. This refers to the lack of communication and common goals internally at organisations and externally between organisations. It occurs when separate groups or individuals work together on one project but act on separate, often conflicting, objectives (G. McIndoe, pers. comm., June 1, 2010). On top of this, Bentley (1999) argues that added design controls or covenants can create time delays and increase planning costs due to reviewing plans, highlighting a possible reason for NTP's reluctance. It is not known whether design controls or covenants were put in place by NTP. The private plan change at the time of writing this case study was not operative in the CCP rules and therefore no resource consent for the subdivision of Wigram Skies or building consents has been granted.

Before the conception of Living G Zones, NTP's residential developments predominantly centred on low-density residential design, which can be seen in their past residential developments of Lindon Grove, Waikakariki and Tumara Park. Although Tumara Park was designed to incorporate sustainable storm-water design in the way of swales and detention ponds, these developments were designed with little attention to sustainable building design features, such as passive solar design, and do not have adequate retail convenience for residents. NTP's recent residential developments, such as Lincoln and Prestons (located in Lincoln and Burwood, Christchurch, respectively) which are currently in the planning stages are being designed and advocated as 'innovative' developments. Lincoln is situated outside the Christchurch authority and is the responsibility of the Selwyn District Council who guided this development with a collaborative, multi-disciplinary master-plan similar to Living G's ODPs. Prestons is proposed by the plan change proponent to be zoned Living G. Both subdivisions have been designed to accommodate mixed-density, high green-space allocation and sustainable storm-water management characteristics, which illustrates that even though NTP historically have used conventional methods of storm-water disposal it appears they are moving away from hard engineered, low-density residential development typically found in Christchurch.

Actor Insights.

Ngai Tahu cultural values and Wigram Skies.

From a rural development perspective NTP have major developments where they are converting forestry land into dairy farms, which alone raises questions about their 'cultural' and 'environmental' values. At any one stage NTP have $100 million worth of development activity underway in the South Island making them a leading player in residential development. Tony Sewell, Chief Executive Officer NTP, has previously worked for both traditional development companies. He provides a unique perspective on the differences between NTP and 'normal' developers/development companies, as well as how NTP incorporate Ngai Tahu values into urban developments. In an interview, T. Sewell claimed that NTP has values that are slightly different to 'normal' development companies, especially around the environment. He explained that NTP are trying to look at developments that are sustainable in the long-term, but:

> *"we're not outstandingly different because all developers respond to what the market is looking for. We just happen to be indigenously owned which tends to*

mean that we do things on our projects, for instance Wigram Skies we're pushing storm-water management, there will be more native planting there than introduced plants, there will be markers and signs and designs that are more Ngai Tahu based than European based, so it tends to be around that kind of thing...The other thing with us is that we know everything we do is going to be here forever, and the iwi will be here forever, so if we don't do it right the future generations will be punished by what we do today...so those things are probably the only differences. There is nothing clearly that you could say this is an indigenous one, this is one done by Fulton Hogan, we just have different views on some things" (T. Sewell, pers. comm., November 22, 2010)

This comment was somewhat contradictory to what Mark Pennington, an Environmental Engineer involved in the preliminary design of Wigram Skies, said. He explained that the storm-water systems, which include swales and detention ponds, are collocated with the Conservation 3 zones (described as areas of ecological and cultural significance):

"certainly with the Wigram development the cultural side of things didn't influence it at all and it didn't come into my side of it at all and I never heard about it" (M. Pennington, pers. comm., October 8, 2010).

In addition, T. Sewell declared that NTP is committed to developing greenfield growth areas. Given greenfield growth areas have been subjected to sustainability criticisms outlined in Chapter 2, this seems contradictory to Ngai Tahu's cultural and environmental values, and their commitment to

"the long-term benefit of the South Island and New Zealand [and their dedication] to the sustainable use of resources and sound environmental outcomes" (www.ngaitahu.iwi.nz).

This is not to mention their role as 'guardians and stewards' of the environment – Kaitiatanga. However, in an interview with Te Marino Lenihan, cultural and environmental advisor for Ngai Tahu (social arm), it was explained that efforts are being made to bridge the gap between the social and commercial (NTP) arms of Ngai Tahu. In his newly appointed role, T. M. Lenihan liaises with NTP, a Ngai Tahu environmental team and local people to translate stories and information to uphold Ngai Tahu cultural and environmental values:

"the bridge between the left [Ngai Tahu cultural] and the right [NTP – commercial] was a large gap and efforts are being made by the left to guide the commercial team, such as planting regimes. The thing is the commercial boys were worried that they needed to make money and they have a certain way of doing that. So they follow what they know. So that's probably how it [NTP] started out, but in the future we're looking to start off with a clean slate, we'll look at a piece of land and say what is the natural and cultural heritage of that site and try to honour and enhance those aspects" (T. M. Lenihan, pers. comm., February 22, 2011).

T. M. Lenihan continued by providing an example of how NTP are 'honouring the cultural and natural heritage' of land through a rural example, although it seems somewhat contradictory:

"An example of actually doing this is the rural branch of the property company. So currently there are no new urban developments that I'm aware of but the new frontier for our company is the rural sector, so developing big blocks of land that were traditionally forests and converting them into pastoral use. Our approach on that is exactly what we've talked about, figuring out what value it did have historically and the value it eventually does have and how we can develop it to pay respect to that value" (T. M. Lenihan, pers. comm., February 22, 2011)

Whether T. M. Lenihan is talking about the ‘cultural value’ or the ‘monetary value’ of rural land is confusing. It is, however, obvious that the monetary value of converting forest and rural land into dairy farming activities outweighs the environmental and traditional cultural mahinga kai (food) protection values echoed through Ngai Tahu’s ‘2025 Vision’. This is a document which outlines the long-term vision for Te Runanga Ngai Tahu. In answer to a question about the sustainability of dairy farming and upholding Ngai Tahu values, T. M. Lenihan explained that together with local people, the Ngai Tahu environmental team, NTP and central government, NTP’s entry into pastoral land-use will ‘set the standard’, a phrase on NTP’s website that is also used to advocate Wigram Skies, for New Zealand towards ‘sustainable management’. However, dairy farms across New Zealand have been established under the ‘sustainable management’ framework of the RMA, and have produced a variety of adverse effects on local water bodies.

This is a similar argument for urban development in Christchurch, where the ‘sustainable management’ approach of the RMA has produced a continuation of the status quo – low density, car-orientated urban form. NTP’s goal to ‘set the standard’ in terms of modern, innovative housing and communities will now be explored through Wigram Skies. T. M. Lenihan explained that the cultural and environmental side of Ngai Tahu recognises the need to re-evaluate the design of houses so that they produce a product that is affordable and sustainable in terms of energy and water efficiency. This was a comment shared by T. Sewell who explained the value in water sensitive urban design through added amenity values for the consumer.

Water management designs and concepts at Wigram Skies

The storm-water network design at Wigram Skies has been integrated with the CCC’c ICMP and the SWAP. These plans are an example of how the CCC have become proactive with regard to how they expect surface water systems to be designed. Rather than permitting developers to meet minimum standards in their developments, these documents require developers to take into account long-term urban challenges, such as storm-water disposal.

Wigram Skies’ storm-water network consists of urban swales transporting storm-water into retention basins located in the conservation zones. This type of storm-water disposal can be found in some developments in Christchurch, such as Tumara Park and Northwood, although they are not typically practiced. The Conservation 3 zone adjoins the Heathcote River and continues alongside it, as shown in Figure 13 below. This storm-water area will collect some of the upstream storm-water from existing development and the storm-water generated by urban swales at Wigram Skies. Scott Blair suggested that many greenfield areas which are not a product of Living G have a lack of connectivity with existing developments and have become isolated. Thus, Woods Bagot has designed Wigram Skies to connect to existing urban areas, the Heathcote and conservation zones, through the collocation of cycle-ways, pedestrian routes, bus networks and various road linkages along the storm-water network. The connectivity of internal and external urban environs, and the diversity of transport routes for different modes are important features for the resilience of Wigram Skies. The connectivity of transport routes and collocation of storm-water networks are displayed in Figure 14 below.

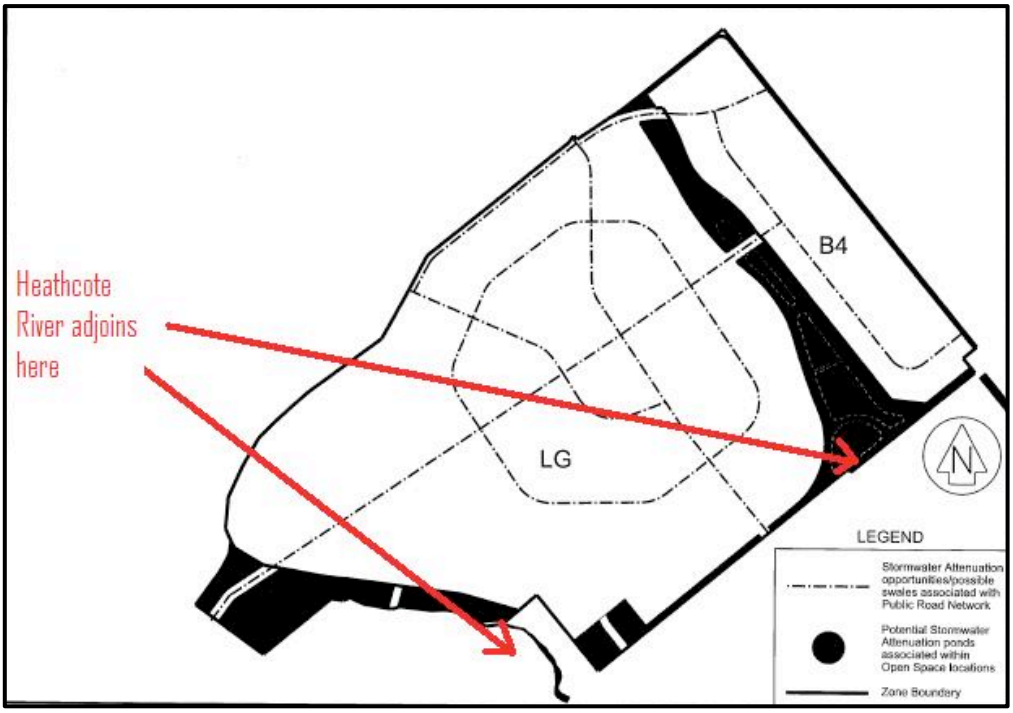


Figure 13: Wigram Skies' urban swales connecting to Conservation 3 zones. Urban swales are collocated with transport infrastructure and can be compare with Figure 12 to illustrate this. Source: (CCC 2010c).

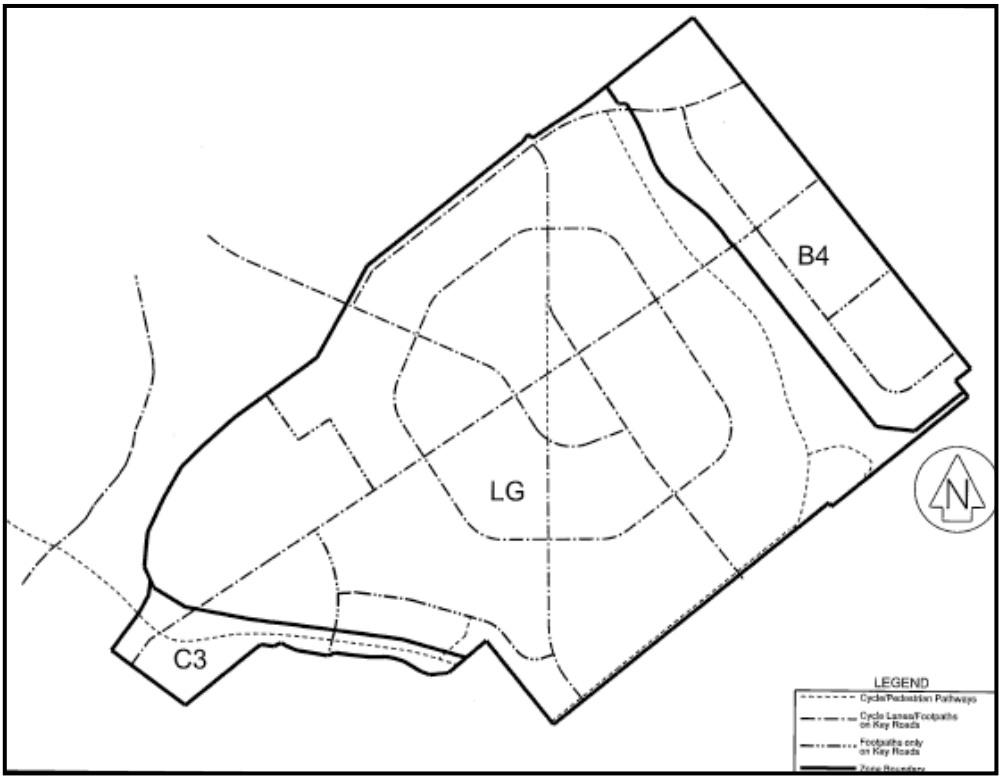


Figure 14: Cycle and pedestrian networks at Wigram Skies. They are collocated with conservation zones and urban swales, and also connect to surrounding existing urban areas. Source: (CCC 2010c).

There have been no other water management measures carried out at Wigram Skies. T. Sewell explained that they had considered providing water reuse systems, through capturing roof runoff. This is considered best practice in terms of water management (M. Pennington, pers. comm., October 8, 2010). However, the CCC does not favour this activity due to a perception that residents would not maintain the systems correctly. This is also a common argument for the maintenance of swales, although it is councils who do not want to maintain them due to cost constraints (T. Sewell, pers. comm., 2010). In an interview with Tony Moore, Principal Advisor on Sustainability at the CCC, the negative perception of grey-water reuse was explained in terms of health concerns and cost:

> *"Its just too hard, there are health issues related with it even if you are using water out of your washing machine or your shower, the reality is that it is off a human body, underpants, so it does have bacteria in it. That is the simple reason why we are not doing it, it is just too hard. There is a health concern, there is a cost concern because why would you do it when the cost of water is free, as the rate payers would say" (T. Moore, pers comm, July 19, 2010).*

This comment does not explain why rain water harvesting is not favoured by the CCC, considering it is used in the new civic building in the city centre, and gives a short-sighted view on the benefits of grey-water reuse. Chapter 2 highlighted that as climate change effects continue, Canterbury is expected to become dryer potentially placing Canterbury's 'plentiful' supply of water at risk. T. Moore explained that a 'pricing mechanism' would be placed on water consumption in the future to change water consuming behaviour. However, as well as a price mechanism, incorporating water reuse systems into urban developments provides an opportunity to continually reuse grey-water and reduce potable water consumption. The treated waste-water could be used for domestic activities, such as car washing, toilet flushing and gardening. Not only this, but distributed waste-water treatment facilities may provide an opportunity to create a water and waste-water infrastructure system that could be resilient, if run on renewable energy, not only to peak oil and climate change, but also to earthquakes. Having a distributed system rather than a centralised system could reduce the extent of areas affected by earthquakes and widen the availability of water supply in times of natural disaster. In addition, distributed waste-water treatments may be less energy intensive than the current system which transports waste-water 3kms out to sea.

Energy efficient technologies and design

There was a clear recognition from all CCC respondents that buildings and homes have the potential to be carbon neutral or generate energy which would reduce Christchurch's carbon footprint and in turn the impact the city has on climate change. T. Sewell explained that although NTP wanted to install energy efficient technologies at Wigram Skies, such as solar water heating systems or solar voltaic systems, a perception from a focus group conducted for NTP suggested that homebuyers did not want to pay the additional costs on top of their house purchase (pers. comm., November 22, 2010). When asked whether NTP considered buying solar systems in bulk to supply the market and use it as a possible incentive for home buyers and create a 'point of difference', T. Sewell explained:

> *"well you're sort of interfering with market forces there though and we don't tend to want to do that. We want people to be able to make their own choices. It should*

apply that if New Zealanders want solar heating then prices should drop, but I think that market forces is bullocks. But yeah that could be an incentive, for every section you buy you get a solar heating system for your house or a discount or whatever. I suppose we haven't needed to, so we haven't. But maybe there is a lack of commitment, sustainability we're there but we're not going over the edge with it though. We're playing the game between what the market is used to and pushing the barriers out a wee bit. We're not going total sustainable stuff" (T. Sewell, pers. comm.,2010).

This comment indicates a lack of requirement from governmental authorities in regards to passive and active solar design and suggests that NTP are not 'setting the standard' very high, like T. Sewell's previous comment and their online marketing through their website suggests. In addition, it could be argued that NTP are already interfering with market forces through flooding the market with affordable greenfield housing, thereby influencing consumer choice and demand for such housing. No other information could be gained from NTP regarding energy efficiency and renewable urban energy generation, other than the fact that there is a consumer mindset that the long-term paybacks of such systems do not outweigh the large up-front costs. To the knowledge of the researcher, double glazing and insulation will be the only energy efficient measures carried out at Wigram Skies, as these are required under the Building Act (2004).

Sustainable urban development in Christchurch.

It was made clear in all of the interviews with CCC respondents that there was a clear commitment to sustainable urban development by the CCC. This was generally provided through exemplar documents and programs, such as the Energy Strategy, Health Promotion Through Environmental Design (HPTED), Better Places, Better Places project, the Natural Step Framework and Target Sustainability. More commonly, SUDwas talked about with regards to the CCC's Proposed Sustainability Policy. This policy aims to embed sustainability into council decisions and activities, and the wider public community. But despite this apparent commitment to sustainable urban development, a series of definitions given by council respondents in separate interviews showed a lack of a shared internal vision and interpretation. The comments below provide an example of internal 'silo thinking' where there is no common consensus as to what sustainable urban development means within the CCC:

"Oh dear, that is quite a toughie really. I can't really give you the Council's interpretation, I can only really give you mine. When I look at a greenfield growth area, and I'll put this terms of greenfield growth areas, I'd like to think that the Council looks at an area of land and decides what is the effectively the carrying capacity that piece of land, how can we fit the required density in this land without having to alter that area to the point where we've brought in so much hard engineering that it bears little resemblance to the way it was in the beginning" (S. Blair, pers. comm., 2010).

"I can't speak for the council, its a forward issue. Look for me, I'm a purist I just kinda think that sustainable urban development is something that is not closing off foreseeable options for our children and you can take that to the extreme and would stop you doing a lot of things. In a pragmatic view its about how we can be more efficient in the way we use land and resources and more energy efficient and preserve natural environments and allow future proofing in terms of transport. (H. Nicholson, Urban Designer, CCC, pers. comm., July 20, 2010).

> *"I really like the phrase Beacon Pathways [who are a research institute focussing on the transformation of New Zealand homes and neighbourhoods] has come up with, which is to help build better neighbourhoods and homes that don't cost the earth. To me that is basically what we are talking about here, we are talking about cost in terms of dollars, the people, but also about harm to the environment as well. So what we are saying here is a place which supports the social activities, so it is a communal place where people meet and talk to each other they nice conversations, they can walk easily, they can cycle easily. So it is a low energy community, it is a strong community or a neighbourhood and it functions well into the future and doesn't cost the earth: so it is affordable but no harm to the environment" (T. Moore, pers. comm., July 19, 2010).*

In an interview Jenny Ridgen (Program Manager Healthy Built Environment, CCC), suggested that there are always going to be differences in interpretation, because it often depends on the individual or group's discipline or focus (pers. comm., July 22, 2010). Respondents outside the council shared this variation in definitions, although it was generally regarded as 'site specific' and entailed the generic 'sustaining resources for the future' response. In the RMG Focus Group (Private Planning Consultants), a conversation between two respondents highlighted the shortfall of the RMA in its definition of sustainable development:

> *[R1]"I think the other biggest problem now is exactly what the definition of sustainable development is as well, you could find 100 different ways by 100 different people, there is no consensus or idea about what sustainable development is. Everyone has their own different idea and interpretation of it"*
>
> *[R2]"If you look at section 5 of the Act most people concentrate on one particular part which is the reducing, avoiding and mitigating adverse effects to the environment and they don't really look at the rest of the definition at the top"*
>
> *[R1] "Yeah that is kind of my point as well, because everybody can look at the bit that they want and say well according to the RMA sustainable development is this and somebody else can read that statement and come up with a different interpretation of what they think is sustainable development" (RMG Focus Group, pers comm, September 24, 2010).*

T. Moore acknowledged the problem that the council does not articulate a consistent view of sustainable urban development to the wider community, resulting in developers, planners, policy analysts and other private development professionals not knowing what the council means by sustainable urban development.

In terms of how sustainable urban development is practiced, it was indicated by all of the CCC respondents that the priorities of sustainable urban development surround storm-water management, open space, transport, energy and mixed densities, which were generally talked about with regards to the Urban Design Protocol. This is a voluntary commitment to specific urban design initiatives encompassing groups, such as Central Government, Local Government, design professionals or development sector professionals. RMG actors also referred to the Urban Design Protocol as a reference for sustainable urban development, but also made the point that many developments seek guidance from outside New Zealand. An example is the US Green Building Council's LEED certification that encourages the adoption of sustainable green building and development practices through a rating system that recognises projects that implement strategies for better environmental and health performance. H. Nicholson and M. Pennington indicated in their interviews that a lack of

guidance from Central Government, in the way of policy statements or established and accepted design criteria, is hindering sustainable built outcomes for residential developments:

> *"my opinion is that they [Central Government] are really good at coming up with these big high objectives, like the RMA, and then they devolve all the responsibility to local authorities and I think it is an incredibly inefficient system. Every council has to reinvent the wheel and do the research to figure out how to do sustainable urban development and actually some national standards would be a really good thing and they don't provide that" (H. Nicholson, pers. comm., July 20, 2010).*

> *"To me some national consensus would certainly help and as an industry we have lobbied the likes of the Ministry for the Environment for a national policy statement of various things and they are a bit slow at coming forward with it, I realise it is a huge task to come up with a document that fits in all the districts and I guess that is the reason regional councils were established in the first place is to push it all towards local control but I think we would benefit from some national guidance, if not control but definitely guidance" (M. Pennington, pers. comm., October 8, 2010).*

With regards to local government guidelines for sustainable urban development, all CCC respondents confirmed that the CCC's CCP, Area Plans, Infrastructure Design Standards or ODPs are their way of guiding sustainable urban development through their connection to the RMA. However, a number of voluntary approaches to sustainable urban development are being attempted by the CCC through displaying various amounts of information on green initiatives in the public realm. These initiatives have been directed at developers, but have been met with little success as it was explained by Hugh Nicholson that the drivers or monetary incentives are not in place to encourage developers to practice sustainable urban development. Such monetary incentives could include, reductions in developer contributions (the amount of money developers pay council for infrastructure costs and maintenance) or fast tracking consent applications if they follow a set of sustainable urban development guidelines, thereby reducing planning costs. Both have the potential to reduce costs for the developer and in turn the consumer. T. Moore explained that the CCC's program 'Target Sustainability' has produced a new initiative called the 'Home Builders Cluster'. This brings together different homebuilder companies that are willing to have a discussion around sustainable urban development practices. He describes this meeting of homebuilders as 'co-opetition' as they are in a competitive market but need to cooperate to raise the level of the sector. They do this through discussing various tools and guidelines that can assist them in creating sustainable homes. He also added there will be a 'Developers Cluster' which will function the same way.

In regards to developer sustainable urban development practices, RMG respondents highlighted that practicing sustainable urban development from a developers' point of view was subject to the consumer and requirements set out in council plans and legislation. One respondent asserted:

> *"I would say that in most cases design is applied, driven through returns and getting their consents through. There are no mandatory requirements or plans or legislation so they [developers] don't consider anything more that they need to do. In most cases most clients will do what they can get away with, they'll go for design features for a marketing point of view but not for being more sustainable. That is because most council's district plans and subdivision criteria are not really designed around sustainable outcomes they are more made around specific events, like traffic congestion or density, making sure services work" (RMG Focus*

Group, pers. comm., September 24, 2010).

The inability of district plans to replicate sustainable design outcomes may be a result of the resource driven aspects of the RMA. The idea that the market is a driver for sustainable urban development practices was also confirmed in an interview with Peter Cook (Register Property Evaluator and Real Estate Agent), who after explaining the common features of a home that purchasers want (four bedroom with two/three car garage, large living rooms and kitchen, on-street parking and indoor, outdoor living) stated:

> *"In the end it is the market and the market demand that changes things and if people in Christchurch can't be persuaded that it is beneficial to live in sustainable, high density housing because of transportation and other benefits, then I don't think we're going to move" (P. Cook, pers. comm., July 23, 2010.*

He also insisted that the market has a conscience of incorporating sustainable elements to a house but there is also a limit to what customers will pay. Therefore a market for sustainable homes is potentially present but not a bulk market that will encourage developers to proactively pursue sustainable urban development practices. These comments highlight consumer choice or preference as a major barrier to sustainable urban development and design. This is supported by Bowman and Thompson (Bowman & Thompson 2009), and Hostetler and Noiseux (Hostetler & Noiseux 2010), who conducted research on consumer housing preferences and sustainable subdivisions the USA. Both these studies suggested that there is a growing preference for sustainable urban design from the market.

Perceived barriers to sustainable urban development in Christchurch

In development practices and urban governance, conflicts between actors are evident. These are generally with regards to conflicting objectives or performance conflicts, where actors are not delivering in terms of timeframes or expectations – ie silo thinking. S. Blair explained that there are always a few 'hiccups' during the planning process and there always will be as the different actors' objectives do not always align (pers. comm., July 19, 2010). A common actor conflict raised by H. Nicholson and S. Blair was between traffic engineers and urban designers who approach developments from a different point of view. The traffic engineer's priority or focus is to keep the transport system functioning and efficient through vehicle capacity, vehicle safety and speed limits. The urban designer takes a broader assessment of the green environments, liveable environments and their relation to the street to collocate these with walking, cycling and public transport to make traffic flow well in a balanced environment.

An obvious barrier to sustainable urban development identified in Christchurch is cost, both to the developer and the consumer. However, a respondent in the RMG focus group also indicated a lack of requirement from governmental authorities influences developers mindset to pursue status quo urban form:

> *"most developers are cost driven and particularly at the moment because the development cycle is at a bit of a low and whether it is money or things they don't have to do, and until there is a mindset and a requirement for them to actually*

consider those issues in depth they are going to put them [sustainable features] to one side and concentrate more on your perception and costs of the development" (RMG Focus Group, pers. comm., September 24, 2010).

M. Pennington explained there is a mindset amongst developers who often go for the cheapest upfront costs and do not invest in consultants in the early design and planning stages so that everyone involved in a particular development has a shared vision for the end product:

"They actually need to get over that and invest more in professionals early on in their development process rather than bringing them in when things have all gone wrong to try and rescue the process. Because what sometimes happens is we'll get called in to fix an issue and its a hell of job to try to make something work out of a dog basically, if it never was a good development in the first place. So that to me is probably the fundamental thing" (M. Pennington, pers. comm., October 8, 2010).

In addition, it has been indicated that developers tend to steer away from sustainable features in a house or neighbourhood as certain features can increase the costs to the developer and in turn the consumer. Peter Cook suggested that even though consumers like the idea of sustainable features, they are not willing to pay for them. He put forward that there is possibly a market and psychological resistance to moving individual home occupiers from where they are now, low density residential environs, towards sustainable neighbourhoods, which are generally medium to high density living environments – as in New Urbanism. As outlined in Chapter 2, this is due to the perceived aspirations of people who live in Christchurch and people who migrate to Christchurch wanting the 'two car garage, house and garden package'

The cost barriers for the council revolve around the maintenance of the green-spaces and storm-water networks. These features become council assets after the developer constructs them, and the CCC has been known to refuse developments with 'too much' green-space, thereby reducing the quality of the built outcome. This becomes a problem in some areas in Canterbury if development objectives are not aligned with council's sustainable asset management. Even though a new development might provide good amenity outcomes for future residents, it may have financial implications for the long-term management:

"just like a developer is driven by cost to maximise profits the council is also driven by cost because they have to manage their assets and give value to the rate payer. So even though what is considered to be best practice by providing good public accessibility to open space, it is sometimes seen as a poor outcome for the council because they have to pay for the maintenance of it" (RMG Focus Group, pers. comm., September 24, 2010).

H. Nicholson highlighted the legalistic nature of the CCP and its lack of ability to require developers to practice sustainable urban development in terms of the CCC objectives and visions for the city as a barrier to creating sustainable residential developments:

"We're very legalistic and we tend to be challenged a lot and we don't as much power to simply require developers to do things how we would like to see it. Its very much a 'you can do anything you want as long as it doesn't have negative effects on the environment', we're always running round trying to prove that it doesn't have negative effects on the environment. So it makes it quite hard to lift the bar, there is that mentality that 'everyone else has already done it how come

it's negative now?'" (H. Nicholson, pers. comm., July 20, 2010).

This comment adds to the argument in regards to the plan/resource driven nature of the RMA outlined in Chapter Three, whereby the ponderous process of the Act produces low quality developments as developers stick to what they know will be allowed. In addition it adds to the interpretation criticisms of sustainable urban development, more specifically, the varied interpretations of what constitutes negative or 'adverse effects'. The latter part of Hugh Nicholson's comment also identifies a lack of awareness or acknowledgment amongst developers about past urban development practices and their implications for the challenges of climate change and peak oil. This could be a result of the lack of requirement by local and central government and/or inexperienced or underequipped planning professionals not being unable to convey a long-term urban development message to developers.

Summary

The conception of the 'living G' zone illustrates CCC's proactive approach to attempting to manage the effects of greenfield development. This is also evident in the SWAP and ICMP. Although Wigram Skies has been master-planned to accommodate mixed density housing and a sustainable storm-water conveyance system collocated with active transport infrastructure, it does not exhibit 'best practice' energy efficient design (active or passive) or water reuse systems. Ngai Tahu values may become superficially evident through urban artworks and planting regimes, although Awatere et al.'s (2010) Maori design principles outlined in chapter Three were not mentioned by any NTP actor and there is no indication that the cluster, whare style housing will be constructed. In addition the indication that NTP will continue to develop greenfield land poses questions about their role as 'stewards and guardians' of the land. However, Te Marino Lenihan's role as cultural and environmental advisor for NTP will play an important role in bridging the gap between Ngai Tahu values and their development practices. It has been illustrated through this case study that 'cost' is a barrier for the three main players in urban development: developers, consumers and councils. Developers and consumers are directly linked through consumer preference and the marketability of 'green' developments. The CCC cost issues revolve around the maintenance of public space and sustainable storm-water systems. Internal silo-thinking was evident within the CCC and externally between the CCC and developers. The RMA's resource management, plan-driven focus was highlighted as a constraint to sustainable urban development, as well as its inability to define sustainable urban development and 'adverse effects' in a way that provides innovative built form outcomes. In addition it was indicated that there is a lack of central government interest in influencing on built form outcomes.

Chapter Six: Case study – Kirimoko.

Kirimoko, Wanaka, New Zealand is being developed by John May, a self-professed environmental developer. Although this term has no set definition, 'environmental developer' could be characterised as someone who is environmentally conscious and aware of the need for humans to coexist with nature, rather than endeavouring to control it. This consciousness means that he/she seeks to provide residential developments that enhance the landscape in a socially and environmentally acceptable manner that is also financially feasible. This contrasts with the cost minimisation approach taken by many developers who have little regard for social systems and the effect of urban sprawl on the landscape. John May's Kirimoko follows principles similar to 'conservation subdivisions' detailed in Chapter Two. It is a landscape-based, low impact storm-water design with residential cluster housing. On top of this Kirimoko incorporates active and passive solar design options, individual home rain water harvesting systems, and a community management body that governs community issues. This is an uncommon residential design approach for the Wanaka region, as well as the wider Otago region and New Zealand. This case study will explore the extent to which John May's environmental values and visions produce a residential development that 'breaks the mould' to 'business as usual' urban development practices. Like the previous chapter, this will be achieved through examining the urban governance system in Wanaka, and how the actors involved in development practices influence the implementation of sustainable water management and energy efficient design.

Queenstown-Lakes District Growth Pressures

The Queenstown-Lakes District (QLD), shown in Figure 15 below, also known as Southern Lakes, is a popular international and national tourist destination situated in the Otago region at the bottom half of the South Island, New Zealand. It is regulated by the Queenstown Lakes District Council (QLDC), a district authority, and the Otago Regional Council, a regional authority. Much the area was founded on gold rush exploration during 1850/60s, but more recently has grown as a result of the tourism market and housing booms. QLD was the fastest growing area in New Zealand between 2001 and 2006 when population increased by around 30 per cent (17,040 in 2001 to 21,600 in 2006), with the same increase in the number of homes (QLDC 2007a). The QLDC (2007a) emphasises growth pressures could contribute to an expected 1,000ha of land being consumed for housing and more than 250ha of land for additional business and visitor accommodation activities between 2007 and 2026. The QLDC (2007a) adds that the demands created by these increases exceed the amount of available land within the current settlements. Therefore to "avoid a major expansion of the District's settlement into surrounding rural areas (and consequent decline in the environmental values which underpin the

District's wellbeing), new development will need to use land more intensively than has been the case to date" (QLDC 2007a: p4). For this reason, the QLDC (2007a) encourages urban consolidation and higher density residential development.

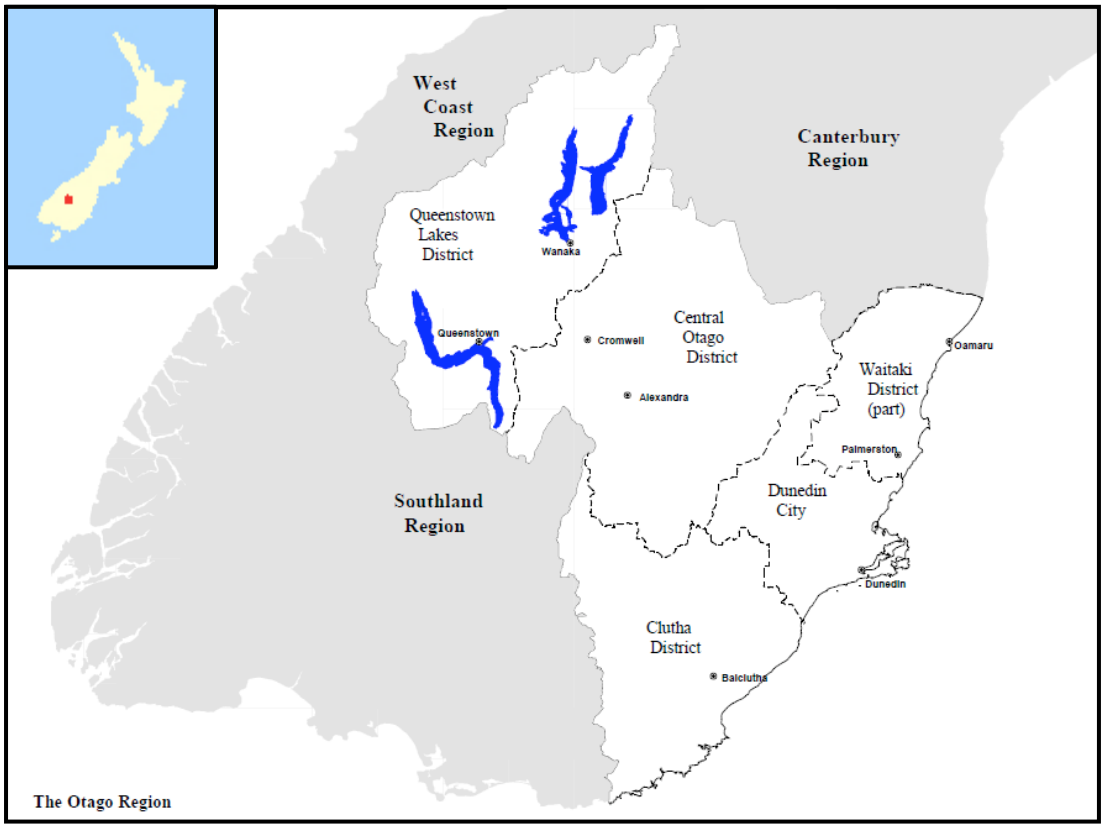


Figure 15: the Queenstown Lakes District in relation to the wider Otago region.

The QLD is geographically split into two wards by the Crown Range that runs between Queenstown and Wanaka, resulting in the Queenstown/Wakitipu ward and the Wanaka Ward. The resident population in the Queenstown/Wakitipu ward is expected to increase from 15,000 in 2006 to 32,000 by 2026, and in the Wanaka ward from 6,000 to 14,500 (QLDC 2007a). In addition, the number of visitors per day in the Queenstown/Wakitipu ward is expected to increase from 11,100 in 2006 to 21,500 in 2026, with the number of jobs increasing also from 11,000 to 24,500 (QLDC 2007a). This is similar for the Wanaka ward which is expected to see an increase in visitors from 5,000 in 2006 to 11,000 by 2026, and jobs increasing from 4,700 to 9,000 (QLDC 2007a). On top of this, it is expected that Wanaka will experience a peak day population of 45,000 (this includes permanent residents, commercial accommodation, short-term residents and day visitors) by 2026 adding to the projected 7,150 dwelling units required by 2026 (QLDC 2007b).

Unlike Queenstown, whose recent growth has been driven largely by the tourism sector, Wanaka's growth has been based on a residential boom due to its attractive environment that makes it a favoured place for a change in 'lifestyle', holiday homes and retirement (Mead 2004). Currently,

Wanaka is characterised by rural or low density sprawling residential development accompanied by a small town centre, largely a result of it being developed as a holiday or retirement destination (QLDC 2007b). As a result it has an ageing population, although it is expected to experience increases in teenagers, adults between 40-60 and adults over 65 years (QLDC 2007b). The Kirimoko development indicated, in Figure 16 below, located 2km north of the Wanaka township and 1km east of Lake Wanaka, is situated within a boundary identified by the QLDC as an area appropriate for residential development. Development on this site will help meet expected demand for housing, but also provide a sustainable exemplar for future urban development in the region.

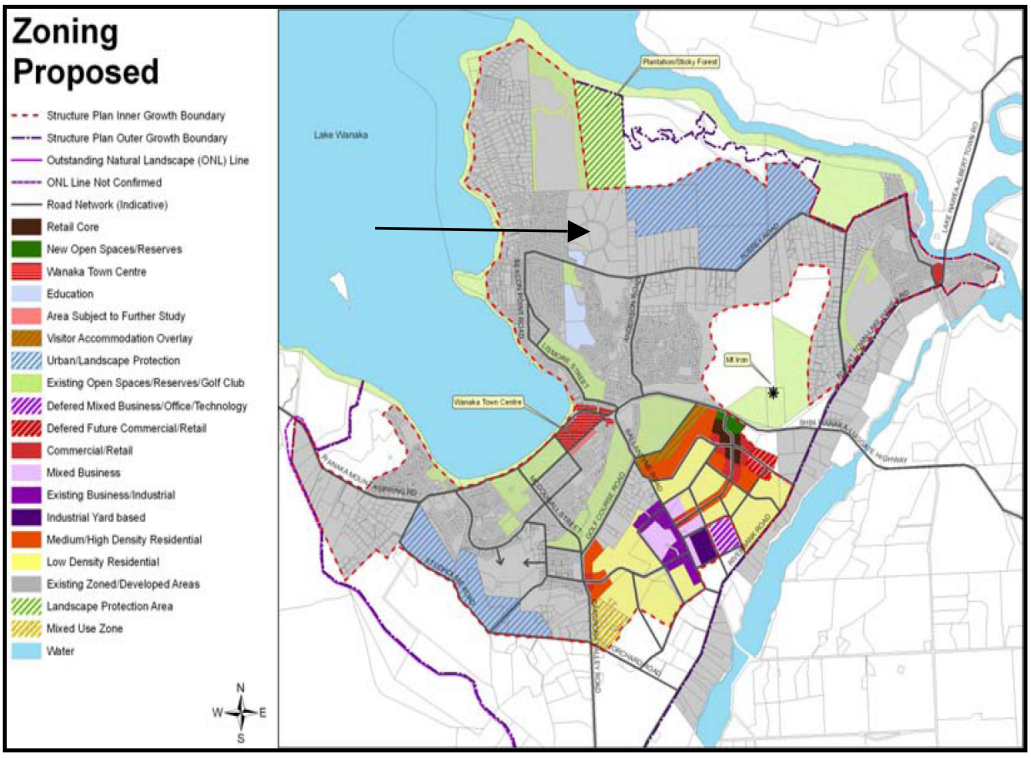


Figure 16: Wanaka growth boundary.
Kirimoko Block is indicated by the arrow. Source: (QLDC 2007b).

Other than that RMA, development practices in Wanaka are shaped by QLDC's Partially Operative District Plan, Growth Management Strategy, and Wanaka Structure Plan. The Partially Operative District Plan is the primary mechanism for the sustainable management purposes of the RMA and outlines specific zoning rules, objectives and policies. The Growth Management Strategy is a non-statutory document that details current and future growth pressures, principles that the QLDC applies to manage these pressures, strategies to apply to the principles, and actions needed to implement strategies (QLDC 2007a). The Wanaka Structure Plan stems from a community consultation study, Wanaka 2020, and is the current policy document consistent with the Local Government Act 2002. It is intended to provide a framework that will guide future development in Wanaka. Similar to the Growth Management Strategy, the Wanaka Structure Plan outlines current and future growth pressures and advocates urban consolidation as a preferred method of land-use development in

Wanaka (QLDC 2007b). The development and planning objectives of Kirimoko are influenced by these documents.

Planning Kirimoko

The Kirimoko Block is owned by 13 separate landowners. This can be seen in Figure 17 below that illustrate the 13 separate section boundaries delineated by red lines. The sections are a result of an existing resource consent which subdivided the entire block into 13 Rural General lots. Given Wanaka's current and future urban challenges, John May, who owns land within this block, saw the current zoning as an inefficient use of land. His vision is to develop this area of land, as well as influencing others, in a manner that steers away from the "ordinariness, ad hoc-ness and lack of imagination" currently visible in sprawling Wanaka (J. May, personal communication, August 4, 2010). Rather than taking the 'business as usual' approach by splitting up the land into a certain amount of sections for higher financial yield and enlisting professionals to 'make it happen', John May employed a team of individual private consultants (Nicole Lauenstien, Ralf Kruger, Mark Pennington, Mike Garland) at the initial design phase to gain an understanding of the various development options for the Kirimoko Block. It was decided through this collaborative approach that a landscape based design would best suit the Kirimoko topography and surrounding rural character. Through this type of approach, the landscape and accompanying storm-water infrastructure was designed first, with houses and additional roading and pedestrian networks overlaid after. The Kirimoko Block was originally zoned Rural General under the QLDC's Partially Operative District Plan (2010) and required a Private Plan Change (Plan Change 13) to provide for comprehensive residential development.

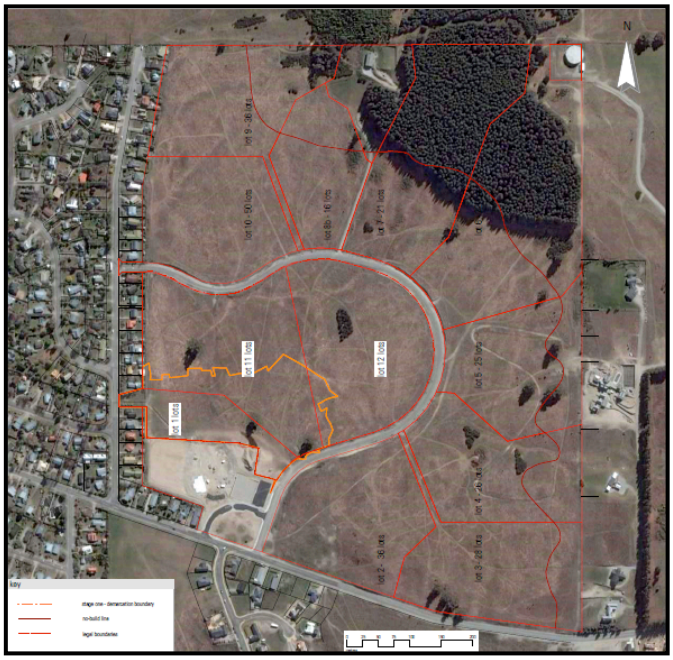


Figure 17: Kirimoko Block.
Source: (Lauenstein, Kruger & Cowburn 2009)

Private Plan Change

Plan Change 13 sets out a series of design objectives that go further than the normal residential rules of Wanaka. It is intended that they will guide the development of the Kirimoko Block towards a more sustainable subdivision incorporating low impact storm-water design. Although these could only be introduced as objectives and policies and not as rules, the proposal has gained strong support from QLDC. The total area of the Kirimoko block is 58.57ha and is expected to accommodate approximately 350 dwellings. The purpose of Plan Change 13 was to "provide for some of the predicted future residential growth of Wanaka by changing the zoning of that land known as the Kirimoko block to enable residential development and the establishment and future development of a Catholic School, while retaining the amenity of the site and surrounding landscape" (QLDC 2008: p6).

Plan Change 13 outlined a Structure Plan of the Kirimoko block, shown in Figure 18 below, accompanied by specific provisions enabling the securing of walkways, roading networks and the Catholic School to achieve this aim. In addition, the Kirimoko block would provide five per cent of its approximate 350 dwellings (17 sections) to meet the QLDC's Affordable Housing Strategy HOPE (Housing Our People in our Environment). As well as this, Plan Change 13 aimed to protect and enhance the visual amenity of the area by creating a protection zone at the top of the ridge (shown in Structure Plan as 'Building Restriction Zone') surrounding the Kirimoko block to preserve the rural character of the area. This zone will also provide opportunities to link habitat communities through the protection of existing Kanuka blocks (shown in the Structure Plan as 'Green Network') and planting additional Kanuka and native flora within the Kirimoko block.

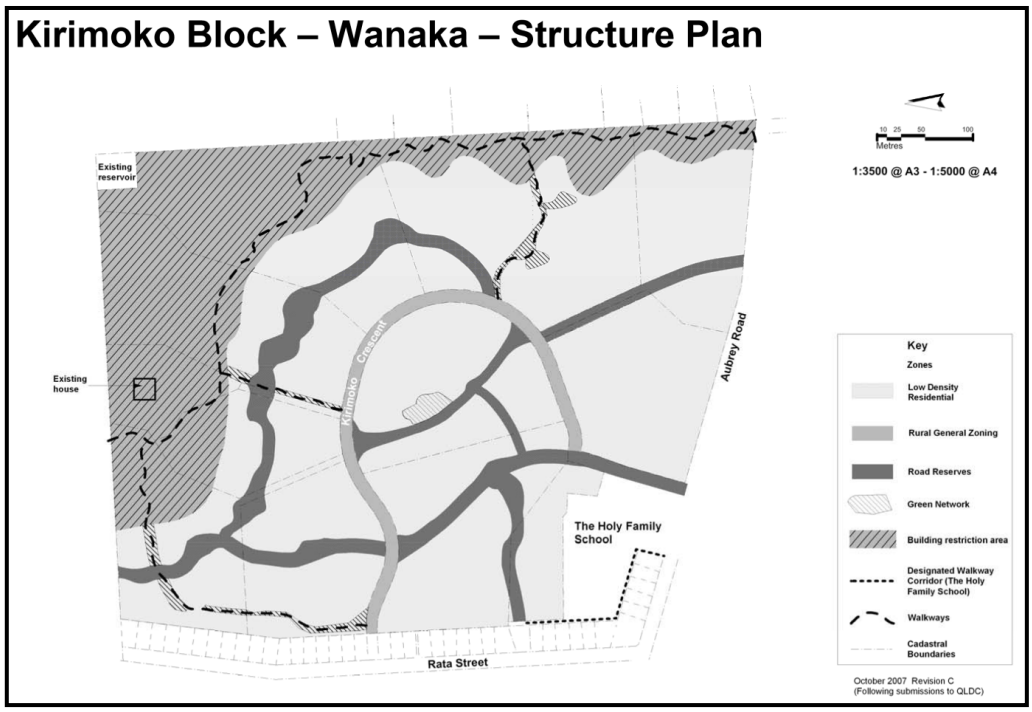


Figure 18: Kirimoko Structure Plan.
Source: (QLDC 2010b: p66)

Plan Change 13 was in accordance the RMA and the functions of regional and territorial authorities, as explained through the Otago Regional Council's Regional Policy Statement (RPS), QLDC Long Term Council Community Plan (LTCCP) and the Wanaka Structure Plan. Consequently, Plan Change 13 became an operative part of the Partially Operative District Plan following council's decisions in 2008. It is now identified under Section 15.1.3 Objective 7 of the District Plan explaining that the aim of the Kirimoko Block is "[t]o create a liveable urban environment which achieves best practice in urban design; the protection and incorporation of landscape and environmental features into the design of the area; and high quality built form" (QLDC 2010b).

Resource Consent Application

The resource consent application that was submitted to the QLDC concerns two of the original 13 landowners, John May and Don Church who have a 50/50 partnership in Crescent Investments Ltd and together own a portion of land within the Kirimoko block. This area of land from henceforth will be known as Kirimoko and is illustrated in Figure 19 below. It will be developed in three stages. Stage 1 is the main focus of this case study and the consent application, and is approximately 4ha comprising of 51 lots: 37 of which will be for residential purposes and the remainder to be utilised for building access to sunlight, storm-water detention and two balance lots for green-space. Stage 1 is illustrated in Figure 19 by the red demarcations on the southern boundary of Kirimoko. Even though the surrounding area is rural in character with low density urban form, the natural landform character of the Kirimoko area led Crescent Investments Ltd (2009), the resource consent applicant, and practitioners to the opinion that it was more suited to higher density development. Crescent Investments Ltd, engaged a number of individual private consultants who were qualified and experienced in the areas of subdivision, land development, hydrology, urban design and landscape design. They were employed at the initial design stage of the Kirimoko and through a collaborative approach designed a comprehensive staged plan. Crescent Investments Ltd (2009) proposed the development of Stage 1 in relation to the overall development of Kirimoko. However, it was indicated in Plan Change 13 that the development methods carried out in Kirimoko, and subsequent stages, will not necessarily be consistent with the rest of the Kirimoko Block development.

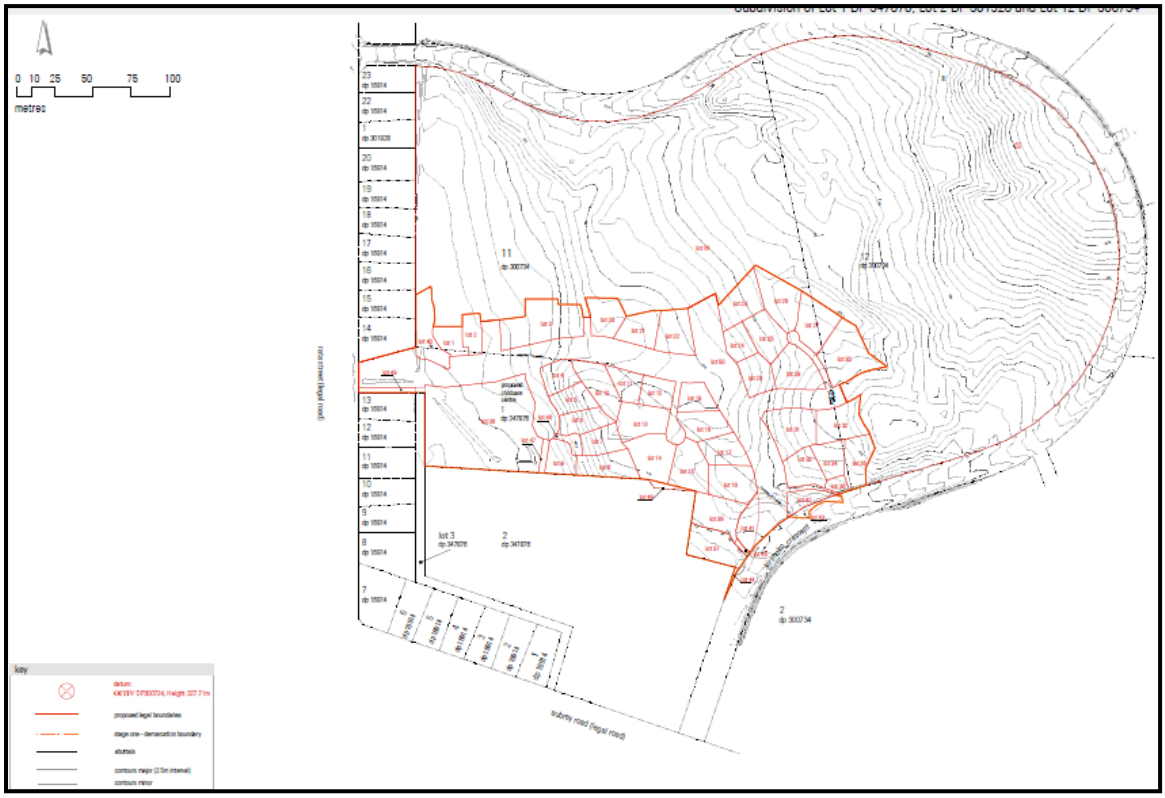


Figure 19: the Kirimoko boundary within Kirimoko Crescent.
Stage 1 is indicated by the red demarcations. Source: (Kruger, Lauenstein & Cowburn 2009d).

Kirimoko's Low Density Residential zoning under the QLDC's Partially Operative District Plan characterises this zone to provide "ample green-space, low rise development and minimal adverse effects experienced by residents" and envisages a minimum lot size of 700m² (QLDC 2010b). Stage 1 proposed to develop two storied dwellings on smaller lot sizes, between 300 and 450m², with an expected overall average lot size of 500m² (Crescent Investments Ltd 2009). As a result the Stage 1 design layout proposal was a 'non-complying activity', meaning that the development does not comply with one or more of the relevant zone standards: in this case, lot sizes. In addition, the consent requested exemption from the QLDC Partially Operative District Plan's subdivision rules relating to height, bulk and location of houses. Instead Crescent Investments would formulate a covenant to impose design controls to specific lots. Crescent Investments (2009) were of the opinion that this would provide better certainty with regards to maintenance of view corridors and access to sunlight for adjoining land owners not otherwise available through the district plan rules. For these reasons, and to actively involve the public, the applicant requested a consent hearing under section 100A (2) of the RMA to present the comprehensive design of Kirimoko in order to provide justification of Stage 1.

Consent Hearing and Commissioners' Decision

As a result of public notification of the Stage 1 Kirimoko consent application, 11 submissions were received by the QLDC in opposition, one in support and one in conditional support. Prior to the consent hearing a public meeting, with approximately 40 people from the community attending, and a pre-hearing meeting, attended by QLDC representatives, were held to discuss the concerns over the

proposed development and the commitments beyond Stage 1. In addition, a 'Section 42A Report' was carried out by QLDC representatives. Under section 42A of the RMA responsibility is delegated by a local authority to a person from a local authority or a consultancy to assess the development in relation to national and local authority policy objectives and can be used as evidence in a hearing. In the Kirimoko case, this was carried out by Michelle Grinlinton-Hancock (a Senior Resource Management Planner of Lakes Environmental, which provides resource management, building control and other regulatory services on behalf of the QLDC (www.lakesenvironmental.co.nz), Dr Marion Read (Principal, Landscape Architecture, Lakes Environmental), Mark Townsley (Principal, Engineering, Lakes Environmental) and Nick Karlovsky (Urban Designer, QLDC).

The consent hearing took place in Wanaka on the 4th and 5th of August 2010. Crescent Investments Ltd was represented by Phil Page of Galloway Cook Allan Lawyers, and was supported by evidence from John May, Ralf Kruger (Landscape Architect), Nicole Lauenstein (Architect and Urban Designer), Mike Garland (Planner) and Scott Edgar (Planner). Persons in opposition who attended the hearing were Lois King and Graeme Dickson of the Wanaka Residents Association. Local authority representatives included the people involved in the Section 42a Report above. The independent Commissioners who facilitated the consent hearing and provided a decision on the stage 1 consent application were Jane Taylor and Leigh Overton.

The proposed development was a non-complying activity and required resource consents relating to land-use and subdivision design. In regards to land-use, it was proposed that 11 of the 37 lots would not comply with the recession plane requirements set out in the zone standards of the Partially Operative District Plan. As well as this, 12 lots of the proposed Stage 1 development would not comply with the density requirements of the zone, which requires lots to be a minimum of 450m²: the 12 lots will vary between 316 – 444m². In relation to subdivision design, 30 of proposed allotment sizes did not comply with the zone standard requiring a minimum lot size of 700m². The hearing took into account the submissions in opposition which expressed concern over the proposed lot sizes and density of the development, and parking, access and traffic volumes as a related factor to the higher density subdivision. These non-complying activities were considered by the Commissioners in terms of section 104 and 104D of the RMA, whereby they assessed and examined the activities with regards to their adverse effects on the surrounding environment and whether these effects would be 'more than minor'. For this reason this section will focus on the non-complying activities and concerns of submitters.

With regards to density and lot sizes, N. Lauenstein (persl comm., August 4, 2010) explained that the increase in density, smaller lot sizes and the breech of recession plane requirements (the angle of buildings/roofs that enable or detract sunlight access) on a series of lots are designed to maximise the amenity of the subdivision. May (2010) made clear that rather than subdividing each lot in Kirimoko to 900m² (200m² above the minimum subdivision lot size of 700m²), which can then be re-subdivided to 450m² (the minimum net area for any Low Density Residential Zone) under the QLDC density provisions. Crescent Investments Ltd aims to deliver smaller sections at a lower price to the consumer by designing them into the development at the start, providing a comprehensive development

outcome. This will be achieved through utilising the natural topography of Kirimoko and allocating each proposed lot a building platform that is spatially orientated to ensure adequate sunlight is available for each future dwelling so that the views from each dwelling do not become compromised.

N. Lauenstein (pers. comm., August 4, 2010) insisted that smaller lots interspersed with larger lots will ensure the character of open space stays intact. Furthermore she also pointed out that the Low Density Residential Zoning of Kirimoko does not mean that all lots have to be large but rather the purpose of the zone is to protect the amenity values of the area. N. Lauenstien and the QLDC (2010a) agreed that having a mix of lot sizes creates a more inclusive subdivision through choice and affordability, thus providing for the demographic and social diversity expected in future Wanaka. The density and lot size design method carried out at Kirimoko, explained by J. May (pers. comm., August 4, 2010), is supported by a covenant document which would restrict further subdivision in Kirimoko offering greater certainty over future sunlight and view corridors, and the design integrity of the subdivision.

N. Lauenstein (pers. comm., August 4, 2010) added that the public open spaces within Stage 1 are designed to provide additional outdoor spaces to counterbalance the higher density living environment at Kirimoko through integration with smaller lots. The informal and formal placing of these spaces was a deliberate design according to N. Lauenstein, who explained that they encourage the interaction of people with their neighbourhood giving the street a main purpose: creating an interactive streetscape or ‘play street’. Conversely, QLDC (2010a) raised concerns over safety and custodial issues of the boundaries between private and public space, and maintenance costs of such spaces as they are largely delineated by planting and storm-water networks. Adding to this argument, Graeme Dickson and Louis King raised issues around property access which related to road hierarchy, parking and the safety and efficiency of the roading network. N. Lauestein (pers. comm., August 4, 2010) declared that the Kirimoko roading network will be pedestrian orientated, whereby walkers, cyclists and cars share the same space to act as a traffic calming measure, creating a safe street environment. The QLDC (2010a) agreed with this and further added that the parking arrangement at Kirimoko complies with the usual requirements of the Partially Operative District Plan and that the 125 on-street car parks are well in excess of what is needed in this development. There was uncertainty as to the maintenance cost of public spaces at Kirimoko from the QLDC behalf. This resulted a ‘condition of consent’ being required prior to each development stage to be submitted to the QLDC. This would outline clear delineations between private and public spaces, and the specifications of on-street amenity which will require maintenance.

Jane Taylor and Leigh Overton, in their commissioner’s Decision Report (2010), explained that overall they were satisfied that the resource consent application is consistent with relevant objectives or policies in the QLDC’s Partially Operative District Plan and that any ‘adverse effects’ of the development are ‘less than minor’. They added that “the proposal will result in sustainable development and is therefore appropriate for this particular site” (QLDC 2010a: p48).

Actor Insights

Developer values and Kirimoko

Even though Crescent Investments Ltd has been identified as the applicant for Kirimoko's resource consent, J. May is represented as the face of Kirimoko through media representation and his active involvement in the Kirimoko design, Plan Change and resource consent application. It was explained in a personal interview that J. May was from Germany and trained in mechanical engineering and business administration. He moved to New Zealand around 10 years ago "mainly for a lifestyle change and loved the country, the nature, the environment and the people" (pers. comm., September 13, 2010). He realised there were quite a few opportunities in Queenstown/Wanaka for land development and with his strong environmental interests became involved in four Environment Court cases relating to the protection of the rural environment and natural landscape: all of them successful. J May has further development intentions in the Wanaka region, although these were not discussed in the interview.

During an interview with J. May, it was clear that he considers New Zealand has a lack of quality sustainable developments and that many of the actors involved in development are happy enough to move ahead on the lowest common denominator. He said that "there is enough sub standard and standard subdivision land out there so we wanted to create a point of difference [with Kirimoko]" (pers. comm., September 13, 2010). His point of difference is that he is interested in not only designing an innovative subdivision with added amenities but also being actively involved in the building of houses and the landscaping of the sections. He intends to establish a construction company that will carry out the building of houses at Kirimoko and is of the opinion that this will ensure his vision for an innovative, flagship subdivision will eventuate on the ground (pers. comm., September 13, 2010). Typically, many developers design the subdivision and rely on council setback and recession plan requirements set out in district plans to guide the outcome of the development. This type of approach does not provide developers with control over the built outcome, potentially degrading their vision and adding to existing sub-standard urban form. In addition, J. May explained that this approach does not provide the home-owner with certainty over what their neighbour is going to do and results in an underutilisation of allotment space and over-utilisation of rural/greenfield land. J. May (pers. comm., September 13, 2010) also indicated he has established a garden nursery consisting of native flora specifically for Kirimoko. The native flora will be partly mature upon planting and will provide residents with instant amenity benefits. This development approach, along with support from a comprehensive suite of covenants and consent conditions, will not only deliver certainty and control over the urban and natural landscape but will "provide a high quality living environment" that may influence "leadership for new development in Wanaka and encourage the community to turn away from lowest common denominator blandness" (J. May, pers. comm., August 4, 2010).

J. May recognises that this type of development takes "courage, time and money" but expresses "[t]hose who criticise us for promoting smaller sites out of some commercial imperative fail to grasp what we are doing, or the complexity of the project" (pers. comm., August 4, 2010). He explained in

an interview that he believes people will soon realise the value in good quality urban environments and that other developers will see that "good urban design is also commercially viable" (pers. comm., September 13, 2010). This viability from a developer and consumer perspective is an area that several authors (Bowman & Thompson 2009; Carter 2009; Hostetler & Drake 2009) have indicated as a common barrier to creating or implementing sustainable urban design, and more specifically conservation subdivisions. Given there is little evidence on consumer preferences of 'green' subdivisions in New Zealand, the approach taken by J. May might provide interesting future research on the long-term vitality of green subdivisions. In addition to this, it would be interesting to identify any evidence about changes in property values of surrounding residential houses, and whether the houses within Kirimoko hold their value better or appreciate faster than those outside the development.

Water management designs and concepts.

A predominant resilient feature of Kirimoko that perpetuates J. May's marketing point of difference is its storm-water management design. It is landscape-orientated incorporating a low-impact storm-water collection, retention and disposal system (R. Kruger, pers. comm., August 4, 2010). The natural landscape features of Kirimoko, such as terminal moraine landforms, and existing vegetation, which include remnant Kanuka trees, Coprosma spp, Matagouri and Carmichaelia, provide a visually significant and ecological relevant area in which to develop a this type of system. M. Pennington explained in an interview that the storm-water system was designed after the natural features of the landscape were retained through boundaries and before the cadastral boundaries (allotment boundaries) were allocated. He added that this approach was achieved through the collaborative design approach at the initial design phase between R. Kruger, N. Lauenstein and himself (pers. comm., October 8, 2010). The three consultants designed the storm-water network to align with view-shafts and sunlight corridors so that each house has some form of view and passive solar design. M. Pennington suggested that this will provide residents with added amenity values and the protection of views and sunlight access (pers. comm., October 8, 2010).

M. Pennington also implied that collaborative design, instead of the 'cut and thrust' approach that designs the landscape and storm-water system after cadastral boundaries are drawn in, will potentially provide J. May with a good return for his investment. The 'cost effectiveness of Kirimoko's design was confirmed in an interview with John May:

> *"I can't give you the exact figure yet but in our instance the low impact design will actually be more cost effective. The problem is that it is more complex, you need to do more planning and you need to have more controls in place and a management plan etc... we see the water as a resource instead of seeing it as a burden, we're using it as a resource in our planting and our storm-water system and that will obviously add to the visual attraction of Kirimoko" (J. May, pers. comm., September 13, 2010).*

The 'working with the land' notion in the latter part of this comment confirms J. May status as an environmental developer. It is clear he understands environmental processes and how these can be used as a marketing advantage and 'point of difference' to other urban developments. The distributed

low-impact storm-water collection and conveyance design is illustrated in Figure 20 below. It consists of three systems; primary, secondary and tertiary.

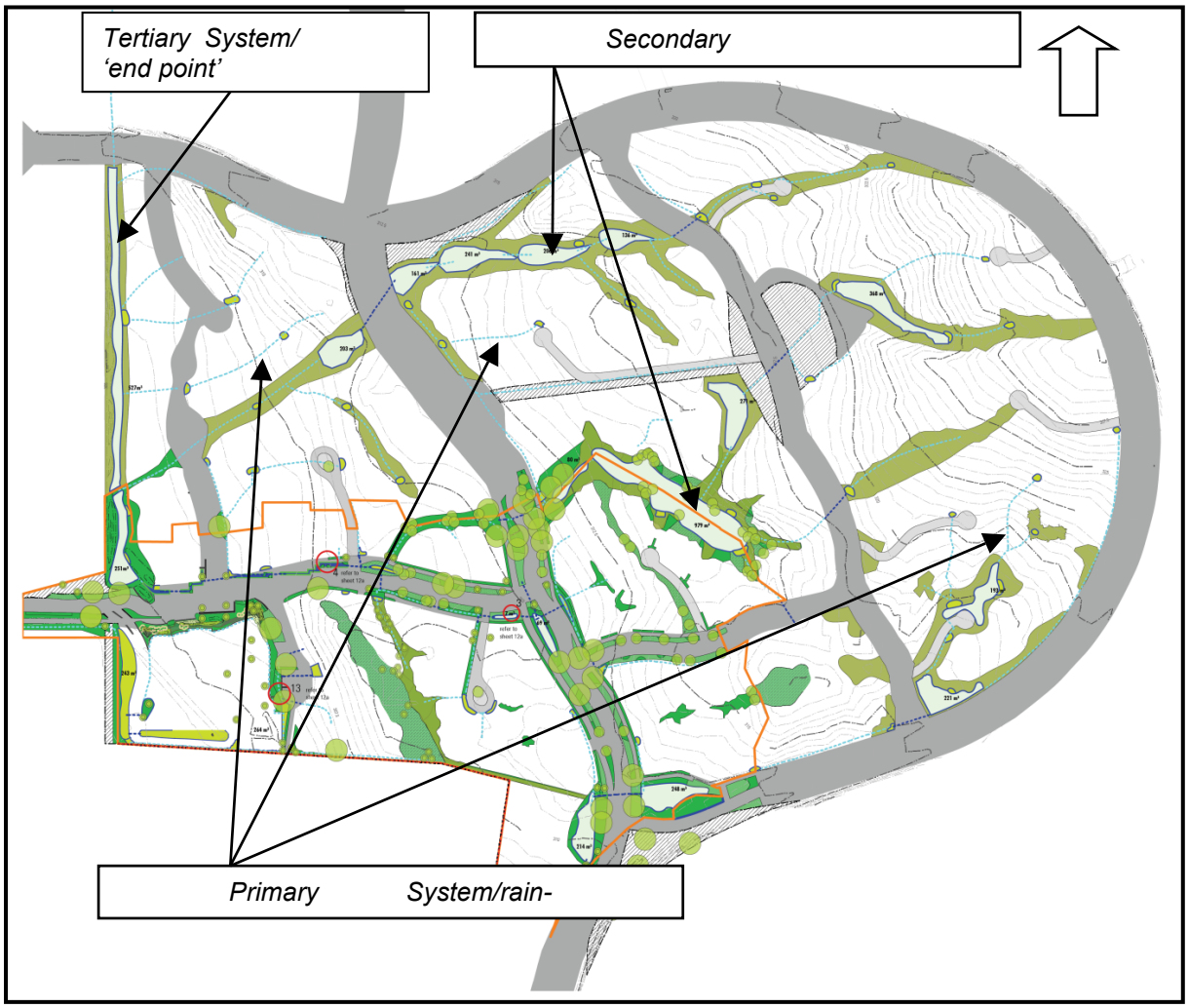


Figure 20: Kirimoko's landscape based, low-impact storm-water system. Source: (Kruger, Lauenstein & Cowburn 2009a).

The primary system is made up of a series of rain gardens located on private and public land, and within road reserves in order to treat surface water at the source (N. Lauenstein, pers. comm., August 4, 2010). M. Pennington (pers. comm., October 8, 2010) suggested that 'at source control' is the new philosophy in terms of storm-water design 'best practice' and will also be incorporated into the design of Kirimoko through rain water collection tanks. Rather than having big black rain water collection tanks on site that have been recognised by M. Pennington as a barrier as they 'look quite ugly', walls that are required to give some form of separation between houses will serve a double purpose and be converted into rain water collection tanks. He elaborated on the 'at source control' concept of the water tanks:

> *"How these tanks will work is you'll have a tank and a tap at some point, the tanks will also have a drain at some level that will drain between rainfall events so the water level can't rise to a certain level. What that does is keep a certain amount of space for temporary storage in a rainfall event. So your main roof runoff will pour*

> *into the top of the tank and once that is full, quite a bit of time would have passed and then the system will start discharging downstream so you're getting a little buffer. In the mean time you've got x amount of space for usable water. So we're looking at things like that for storm-water quality and quantity control" (M. Pennington, pers. comm., October 8, 2010)*

These rain water collection tanks and rain gardens vary in design to adapt to the required water flows, soil conditions and urban settings and a 'first flush mechanism' provides for an efficient contaminant removal and treatment method (N. Lauenstein, pers. comm., August 4, 2010). M. Pennington explained the first-flush-mechanism:

> *"The idea with the first flush is that if you have got a dry period and you got contaminants that collect, like bird dropping or heavy metals, particles bound onto sediments and all that. Those are the sort of things don't want getting into the storm-water system further down and the idea is that the first period of rainfall washes most of those off. So if you can catch that first bit of runoff the remainder can go into your storm-water system but it won't be as dirty. So the first bit is called first flush. Typically we design one between 15-25mm on rainfall depth for the first flush, so if we get a rainfall event, say its going to be 50mm of total rainfall, the first 25mm of that 50 will get taken off to an area where we can deal with all these contaminants. After that lot has gone the rest can go into the broader system". (pers. comm., October 8, 2010).*

He also explained the concept of the first-flush-mechanism as used in a pond form. This concept incorporates the use of a weir in a splitter box arrangement at one end of a pond so that water flows off down to another storm-water system. Water enters the splitter box behind the weir and gradually fills up the pond until it reaches the weir exit which controls the first flush. During the explanation of the weir concept, M. Pennington indirectly highlights a possible barrier to the implementation of these systems in regards to maintenance issues and potential location difficulties:

> *"All the dirty stuff will be at the bottom of the pond, so we locate these systems close to a road somewhere with good access and we can get a digger in there and dig this stuff out every so often. These are the ones that need maintenance more than the others. So you catch all the dirty stuff, put it somewhere where it is easy to clean out and then only allow so called cleaner water into the bigger system". (pers. comm., October 8, 2010).*

After storm-water has passed through the primary system it is conveyed into the secondary system. N. Lauenstein (pers. comm., August 4, 2010) explained that the secondary system is made up of a series of swales and infiltration or detention basins located within natural indentations of the Kirimoko Landscape. They are designed and vegetated to suit specific locations, such as private gardens or road edges, to provide a variety of smaller open spaces and relief from hard surfaces and built form. She added that the tertiary systems, which are infiltration or detention basins designed to manage over flow from the primary and secondary systems, are located at the lowest part of each catchment creating an 'end point' for the storm-water system. This is where the Kirimoko storm-water system links to the existing 'standard' storm-water drainage system. The 'end point' system will also enhance the existing urban form on the west side of Kirimoko through better amenity benefits potentially having a positive effect on house values.

During the consent hearing, N. Lauenstein pointed out that the storm-water network links with existing and future internal relationships to provide natural connections and circulation patterns. The network builds on the natural landscape with swales and rain gardens that extend into private land and public streetscapes to provide more than just a drainage system but also a visual connection with spatially orientated houses. As well as visual connectivity, the storm-water system is collocated with transport infrastructure (roads, lanes and walkways) to create an internal circulation network that also connects to existing urban areas (N. Lauenstein, pers. comm., August 4, 2010). Figure 21 below illustrates the pedestrian connectivity within and beyond Kirimoko by the yellow dotted line.

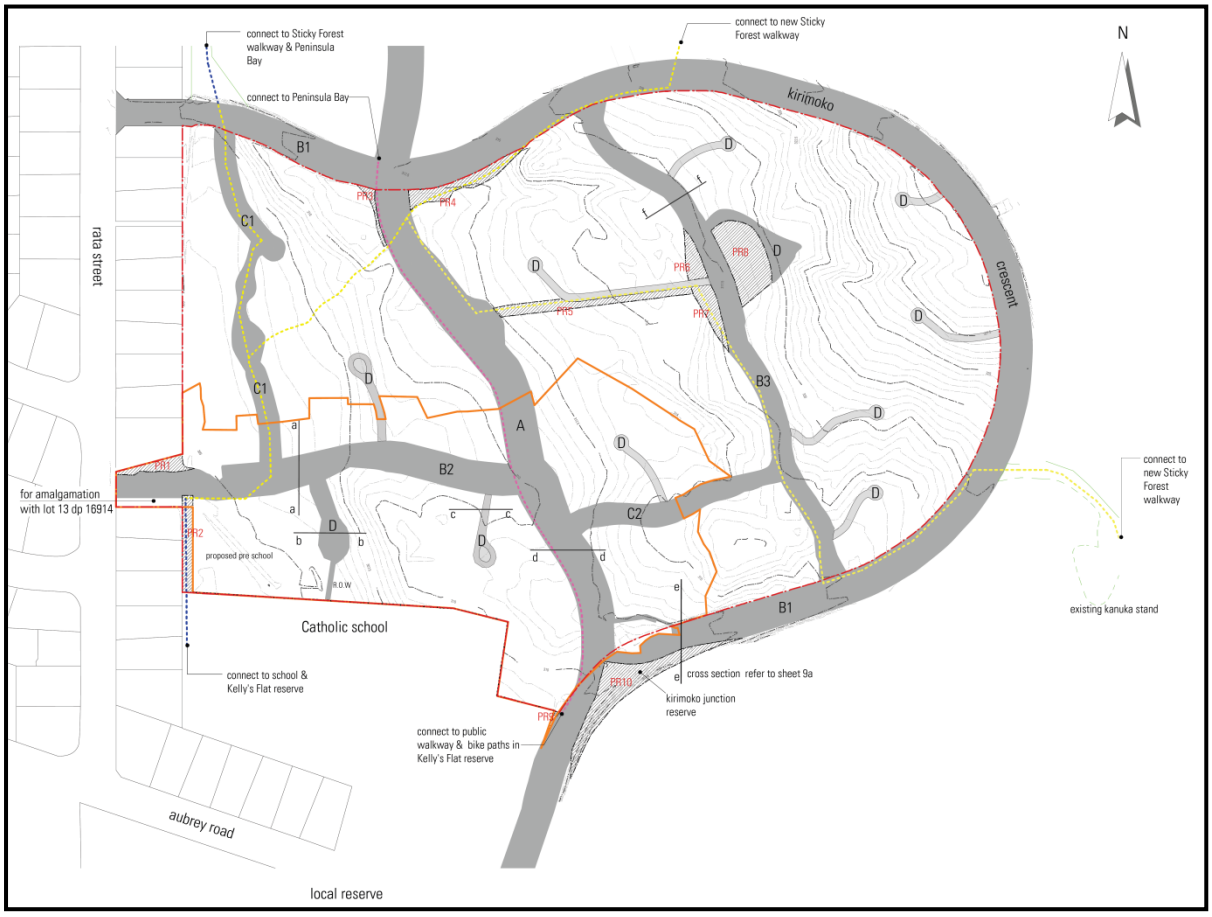


Figure 21: Kirimoko's internal and external transport circulations. Source: (Kruger, Lauenstein & Cowburn 2009c).

As well as providing open space, and opportunities for walkways and views, the storm-water network also enhances the diversity of 'residential clusters' within Kirimoko. There are a total of seven clusters, illustrated in Figure 22 below. N. Lauenstein (pers. comm., August 4, 2010) explained that the clusters have their own unique character derived from existing landform and vegetation that will influence the building typology, bulk, location and orientation in a positive manner so that individual houses engage with the natural amenities that are enhanced by the storm-water system.

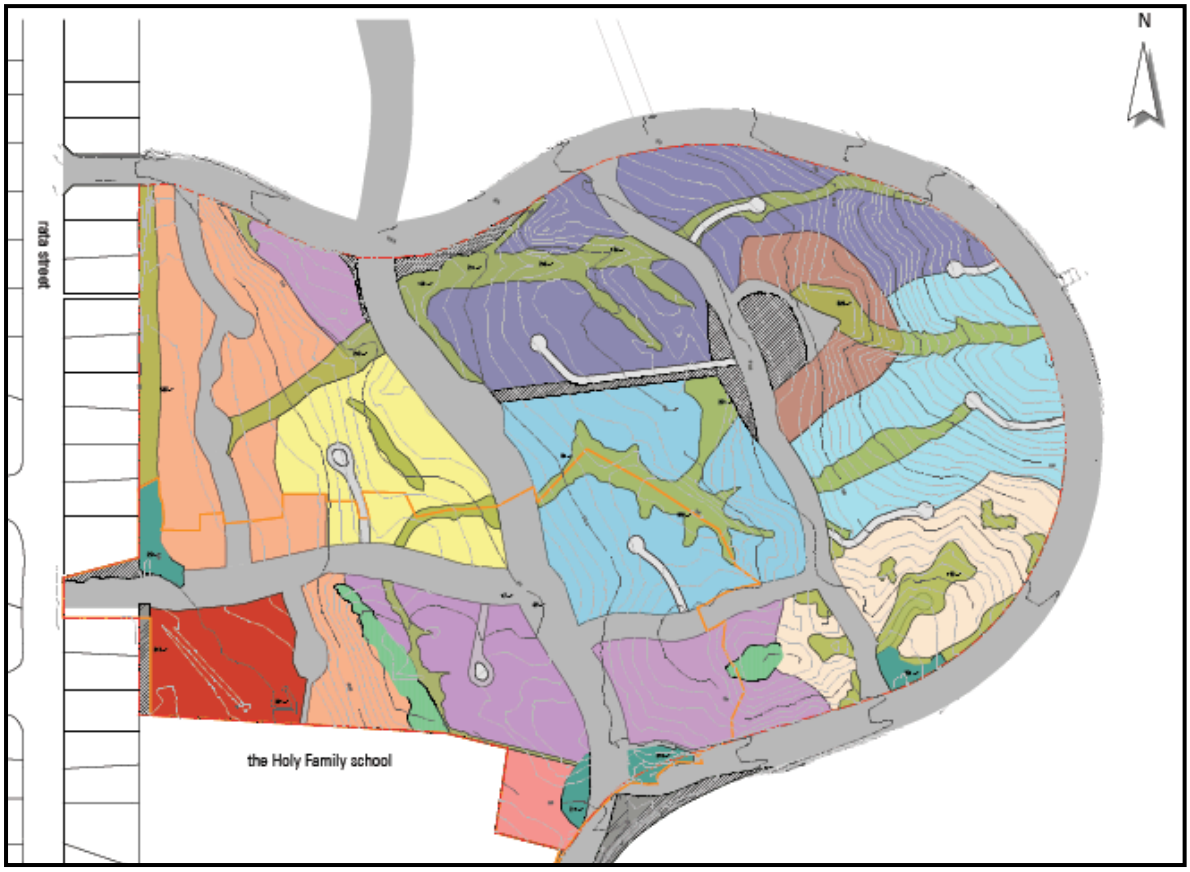


Figure 22: the seven residential clusters at Kirimoko. They are shown here by various colours; blue (top) – Green Gulley Cluster, purple (bottom) – Missing Pine Cluster, turquoise (middle) – Hill Cluster, light pink (right) – Orchard Cluster, dark pink (left) Urban Living Cluster, brown (top middle) – Kanuka Cluster, yellow – Wetland Cluster. The green areas illustrate private green-space/parts of the storm-water network). Source: (Kruger, Lauenstein & Cowburn 2009b).

Energy efficient designs and concepts

The residential clusters within Kirimoko are not only spatially orientated to make the most of the various views within and beyond Kirimoko but also to absorb the natural energy from the sun, an approach generally termed 'passive solar design'. This approach utilises the solar energy to heat homes during cold periods and does not require use of mechanical or electrical devices. During the consent hearing N. Lauestein (pers. comm., August 4, 2010) explained that the clusters of houses designed for Kirimoko will provide better access to sunlight than if left to District Plan rules, through carefully designed recession plane angles and a 10 metre setback condition for building platforms. The Kirimoko covenant controls this and protects individual house sunlight access through restricting further subdivision and heights of buildings.

In addition, a condition on solar equipment is also included in the Kirimoko covenant. This rule requires any dwelling that is erected to specify a location for solar hot water heating and that hot water cylinders are to be 'solar ready'. This does not mean that potential home owners will have to put in the solar hot water heaters but rather that they incorporate the basic infrastructure to enable them to adapt to potential future challenges of power insecurity. While discussing this in a personal interview, J. May (pers. comm., September 13, 2010) expressed his desire to push the boundaries

further with regards to solar energy but believes from his own experiences that any programme or initiative is restricted by market. Even though such technologies could add value to their home, the perceptions of the payback period of solar energy systems do not outweigh the large upfront costs.

Sustainable urban development in the Queenstown Lakes District

The QLDC's Partially Operative District Plan, Growth Management Strategy and Wanaka Structure Plan shape urban development in Wanaka. However, this does not mean that land-use development replicates sustainable urban development, as it has been indicated that many urban developments in Wanaka continue down a 'business as usual' path that produces low density, car orientated urban form. This could largely be a result of outdated rules and standards in the QLDC's partially Operative District Plan. This is a problem identified by Graeme McIndoe who refers to it as 'regulatory lag'. A variety of urban specific strategies have been articulated by the QLDC. These include, the Urban Design Strategy (2009) and the Affordable Housing (HOPE) Strategy (2005), and a guidance document on sustainable building in the Queenstown Lakes District. The Urban Design Strategy has been formulated to guide Council staff and elected representatives on how to influence future urban projects, plans and policies through a series of goals and objectives that perpetuate the urban consolidation development option identified in the Wanaka Structure Plan. As well as this, it encourages future development to provide connectivity between, and enhancement and protection of the existing urban character and natural landscape. The HOPE strategy and the sustainable building document are a guidance approach for developers to encourage the construction of more energy efficient homes. These documents are intended to raise the awareness of the lack of quality affordable housing in the Lakes District. Developers are also given the option to increase their knowledge of the sustainable construction of houses through contacting an Eco Design Advisor at the QLDC.

Despite these various documents that envisage a sustainable urban form, the results of the 'focus exercise' carried out in conjunction with the QLDC focus group provided evidence to suggest that there was no clear Council definition of sustainable urban development. This is not to say council staff did not understand the concept, but rather that there are different interpretations and what was seen as important in terms of sustainable urban development varied between specific disciplines, for instance urban designers, engineers and planners. This, with a lack of a sustainable urban development or sustainability policy, add to a common theme of 'silo thinking' within council and leads to inconsistencies between Council planning decisions, Plans or Strategies, and the urban outcome.

However, developers can protect their 'point of difference' through a suite of covenants. This approach has been adopted by J. May where the Kirimoko 'code' has been developed his development/design team to ensure consistencies and that J. May's 'vision' eventuates on the ground. The covenant applies to the coverage of buildings; rules restricting further subdivision; setbacks from roads, internal boundaries and public open space; rules related to ancillary structures within setbacks; solar equipment; site specific height controls; access location, shared access and moving of access; temporary structures and storage of equipment; landscaping, plants and protection

of vegetation; boundary demarcation; landform and earth movement; and dwelling design and construction related activities (Crescent Investments Ltd 2010). The covenants are tailored to ensure the protection of the storm-water and landscaping requirements, and the protection of amenities for individual houses. In addition, they are intended to provide the owner, designer and builder with a clear understanding of the objectives and values of Kirimoko that are to be taken into account during the design and construction of dwellings and associated landscaping at Kirimoko (N. Lauenstein, pers. comm., August 4, 2010). The covenants are enforced by QLDC and a 'Management Body', which is made up of representatives from the future Kirimoko community and J. May. The management body deals with future development issues that may arise within the Kirimoko community and any issues regarding the Kirimoko Covenants.

Perceived barriers to sustainable urban development

Even though the time allocated to the researcher to conduct a focus group with QLDC staff was inadequate, it did provide interesting evidence on different interpretations of the RMA and District Plans in relation to sustainable development options. This was explained in regards to third party rights, the definition of 'more than minor effects' and proposals attempting to incorporate sustainable infrastructure in new residential developments, such as higher density urban form. It was explained by a QLDC respondent that developers would be more inclined to create innovative subdivisions but the risks (time and money) of attempting such outcomes are dependent on whether or not the development will have more than minor effects, either on the physical or social environment (QLDC focus group, pers. comm., August 3, 2010). In the case of Kirimoko, even though it was in line with the structure plan's urban consolidation approach, the proposed smaller lot sizes were contrary to policies and objectives under the QLDC's District Plan. This indicates inconsistencies between primary council planning documents and is a prime example of 'regulatory lag'. The smaller lot sizes of the development could be deemed to have 'more than minor' effects over how people live in Wanaka, under section 104d of the RMA. Even though the development would benefit the social and physical environments, a small minority who are against Kirimoko or a particular development can use the RMA in a way that justifies their argument and potentially restrict sustainable built outcomes. Another QLDC respondent added developers will generally avoid anything that has uncertainty and will produce subdivisions that are within the Plan rules and the RMA to avoid public notification and essentially more money and time (QLDC focus group, pers. comm., August 3, 2010). This was confirmed by another QLDC respondent:

> *"It's the old planning problem isn't it, minimum standard approach all the way through and anything that has some doubt around it depends on how much the public will allow and developers won't take that risk" (QLDC focus group, pers. comm., August 3, 2010).*

The focus group also revealed that as well as costs to the developer for attempting innovative subdivision design, the long-term costs of maintaining an innovative storm-water system and the accompanying vegetation (like the one at Kirimoko) versus a traditional 'pipe and channel' system was perceived as a potential issue for Council (QLDC focus group, pers. comm., August 3, 2010).

Summary

The landscape-based, low-impact storm-water design of Kirimoko not only provides a sustainable treatment of storm-water and added amenities, but also protects view shafts and sunlight access for houses. The cluster style design of houses are spatially orientated to maximise such views and more importantly to maximise sunlight absorption, otherwise known as passive solar design. The clustering of houses also allows for high quality green-spaces surrounding properties and is collocated with active transport routes adding further amenity and monetary values for the consumer. In addition to passive solar design, active solar design is encouraged at Kirimoko through a covenant requiring the basic infrastructure for solar hot water heating to be incorporated into the design and construction of each house, making them 'solar ready'. In addition, rain water harvesting tanks will be incorporated into the design of each home. Urban governance barriers to sustainable urban development were identified. These related to 'regulatory lag', interpretations of the RMA, and developers' avoidance of the public notification process required under the RMA. On top of this, potential barriers to sustainable storm-water design were indentified, these related to maintenance costs, and the complexity and cost of design. Barriers to incorporating active solar design were also indentified and related to consumer perceptions of the payback timeframe not being worthwhile. Despite these barriers John May has designed a conservation style subdivision that will be resilient to energy and water insecurities providing environmental and social leadership in terms of sustainable urban development in Wanaka. Post-development research will be important for monitoring the effects Kirimoko has on internal and external housing prices, as well as consumer behaviour and marketability of 'green' subdivisions.

Chapter Seven: Case study – Aurora

This case study of Aurora, Melbourne, Victoria, Australia, will also explore the paradox of sustainable urban development and the extent to which individual actors and political/institutional processes influence resilient urban outcomes through assessing the integration of water management initiatives and energy efficient design in a new residential development. More importantly, Aurora will provide an international/trans-Tasman comparison of development practices between New Zealand and Australia to identify differences that influence the quality of the urban outcome. Aurora has been described as being Victoria's 'greenest community' that will provide 'leadership' and 'best practice' in terms of environmental protection and urban design. It is being developed by VicUrban, a state government development agency. It's functions are outlined under section 7 of the Victorian Urban Development Authority Act 2003, but to provide a simply explanation here it is to deliver sustainable urban development, contribute to improving housing affordability, create prosperous communities and to demonstrate best practice and environmental leadership in urban design. Aurora occupies 592ha of greenfield land. It is expected to achieve a 53 per cent reduction in housing footprint (the area of land houses occupy and the area needed to supply resources used in construction and household maintenance), 50 per cent less household energy consumption through six-star energy efficiency standards, 45 per reduction in potable water consumption as a result of water recycling, 11 per cent reduction in transport footprint due to an integrated cycle and pedestrian network, and each home has the potential to reduce greenhouse gas emissions by up to 5 tonnes annually (VicUrban 2006). On top of this, Aurora incorporates a Distributed Water Sensitive Urban Design (DWSUD) to treat storm-water runoff and provide added amenity benefits to residents.

Metropolitan Melbourne Growth Pressures.

Melbourne, shown in Figure 23 below, is one of five major cities in Australia, the others being Sydney, Brisbane, Perth and Adelaide. It covers an area of 7,694km² within the state of Victoria (www.melbourne.vic.gov.au). Relevant agencies of the State Government include the Growth Areas Authority, Yarra Water and Department of Planning and Community Development. The state delegates authority to 31 municipal (local) councils within the metropolitan area, out of 79 for the whole state of Victoria. Historically Melbourne's growth was influenced by pastoral, gold and land speculations aided by transportation innovations (www.melbourne.vic.gov.au). In a recent article, Brian Haratsis, an economist, explains that recent growth has been driven by the success of three key service areas: freight and logistics; education; and health, resulting in Melbourne becoming Australia's

fastest growing city. Although currently second to Sydney, it is set to become the largest by 2035 with between 5 – 5.5 million people (Tame 2010). A document produced by the Victorian Government's Department of Planning and Community Development (DPCD), 'Melbourne @ 5 million' (DPCD 2008b) which is a refinement of their 'Melbourne 2030' (DPCD 2002) long-term city plan, confirms this trend towards 5 million from a current population of 4 million. Conversely, another DPCD document, 'Planning for all of Melbourne' (DPCD 2008c), claims that the city is growing at a rate of around 1,200 people per week with the metropolitan region expected to reach 4.5 million by 2020 and 5 million by 2030. Regardless of the difference between the statistics, it is clear that the population is rapidly growing and will place increasing pressure on the services that provide Melbourne's sprawling regions with water, sewerage, transport and employment infrastructure.

Figure 23: Location of Melbourne in relation to the state of Victoria and wider Australia. Source: (www.esacademic.com).

To accommodate this population growth it is expected that Melbourne will require 600,000 new dwellings over the next 20 years. Both historic and current evidence outlined by the DPCD (2008b) indicates that Melbourne's urban growth has been concentrated in the south-east regions. This is illustrated in Figure 24 below which shows growth trends over approximately 60 years. But there is a diminishing land supply in this area due to physical and environmental constraints in the east/south-

east, which include: the Koo Wee Rup swamplands, the Western Port 'Ramsar' Wetlands, and the foothills of Dandenong (DPCD 2008b).

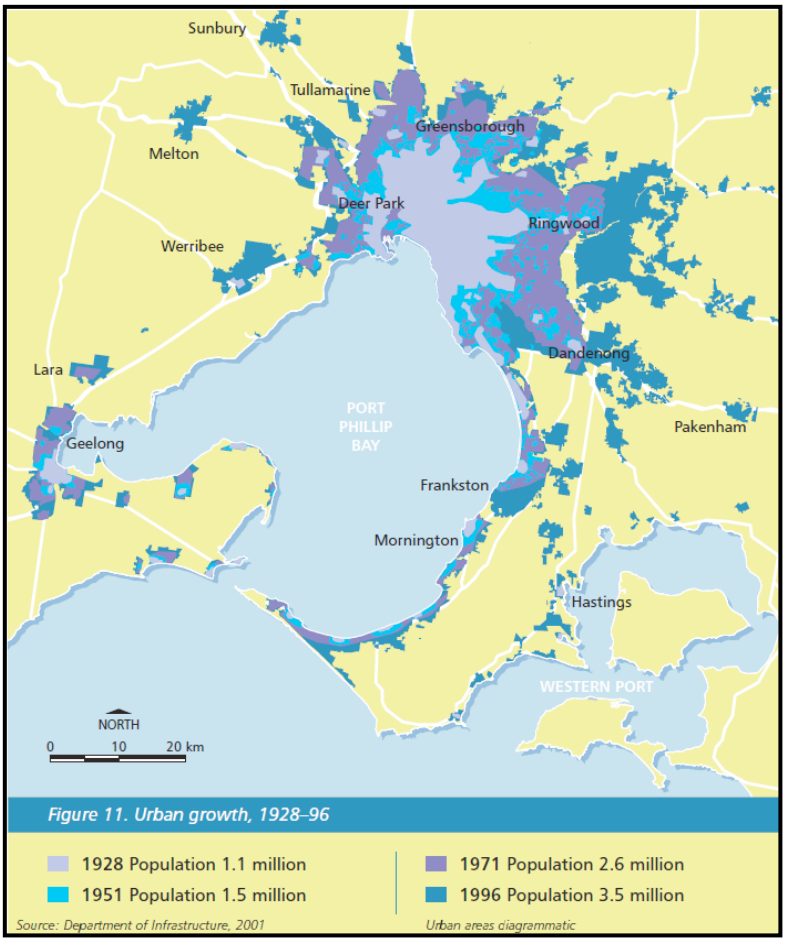


Figure 24: the sprawling nature of Melbourne and the pattern of urban expansion to the south-east.
Source: (DPCD 2008b).

Therefore, DPCD (2008b) proposes an urban plan that will concentrate around 316,000, of the required 600,000, dwellings to be constructed in established urban areas of Melbourne through 'urban renewal' approaches and 'infilling' around public transport networks. The remaining 284,000 dwellings will be supplied through expansion into greenfield areas predominantly in the outer northern and western parts of the city (DPCD 2008b). This will be managed by a recently modified Urban Growth Boundary (UGB). As a result of the UGB extension, five growth areas were identified by the DPCD (2005) in the north-western fringe areas of Melbourne and subsequent investigations were carried out to evaluate their capacity to accommodate significant urban expansion. These areas are illustrated in Figure 25 below and include Wyndham, Melton-Caroline Springs, Hume, Casey-Cardina and Whittlesea (DPCD 2008b). Whittlesea is the largest municipality in metropolitan Melbourne and the fastest growing in Victoria. With 70 per cent of its land being rural, it will take a large portion of this expected growth. Whittlesea is 20km north of the Melbourne Central Business District (CBD), and is

linked to airports, Melbourne docks, CBD and other residential areas through the Metropolitan Ring Road and a new extension of the Hume automobile freeway: indicated in Figure 25 by the pink line starting in the south-west and travelling north/north-east then south.

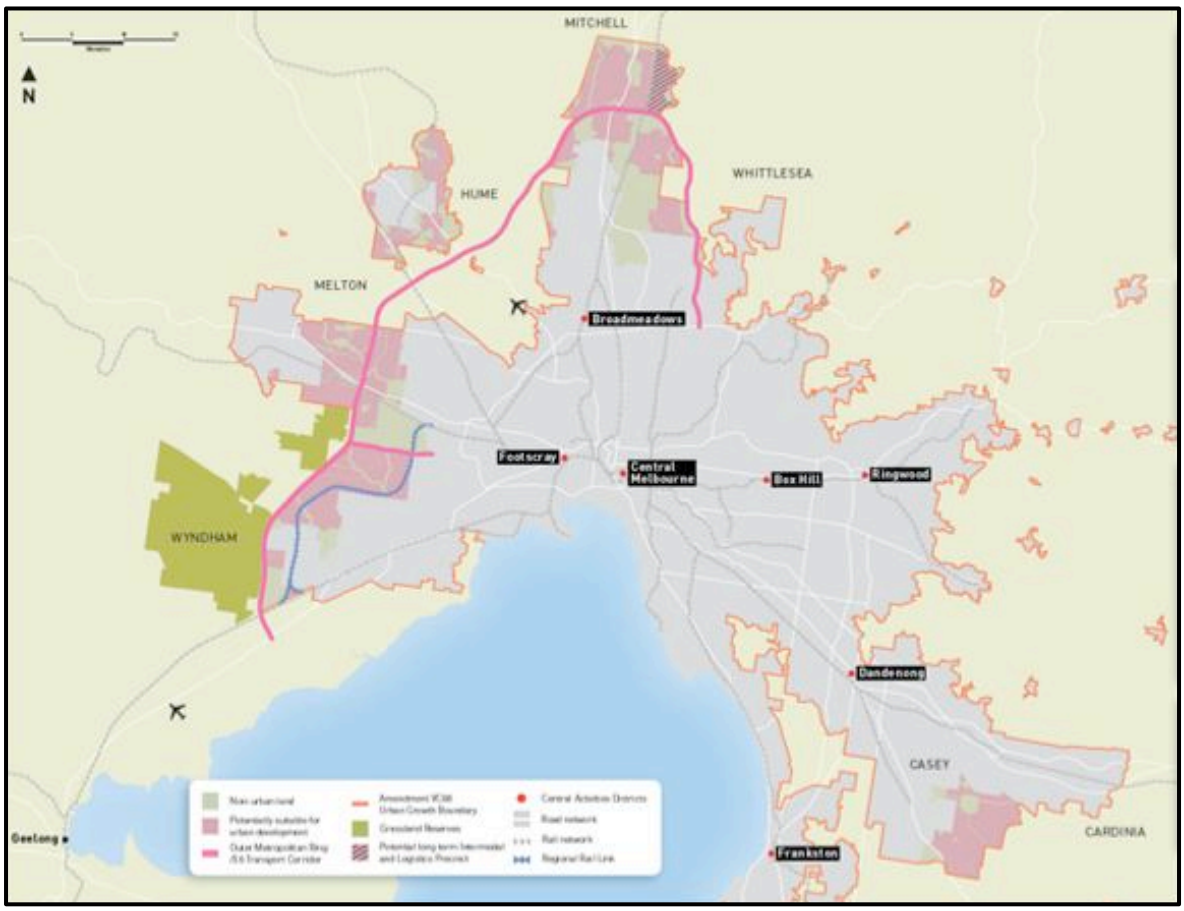


Figure 25: indicates Whittlesea in relation to the wider Melbourne area. The other four growth areas, from bottom left, Wyndham, Melton, Hume and Casy-Cardina in the bottom right. Source: (DPCD 2010)

The population of the Whittlesea (Figure 26 below) grew from 27,000 in 1969 to 146,000 in 2009 due to transport infrastructure developments and housing booms, and is expected to double over the next 20 years (www.whittlesea.vic.gov.au). Whittlesea's population is made up of a high number of people under the age of 25 years, approximately 38 per cent, with a smaller proportion of people in older age groups 60+, approximately 14 per cent. Around 49 per cent are between 25 – 49 years reflecting its attraction for young families seeking affordable homes (www.whittlesea.vic.gov.au). As well as this, it is a multicultural community with over half its residents identifying with non-English speaking nations or being born outside of Australia, in places such as Italy, Greece, Macedonia or Vietnam, highlighting Whittlesea's attractiveness for immigrants (www.whittlesea.vic.gov.au).

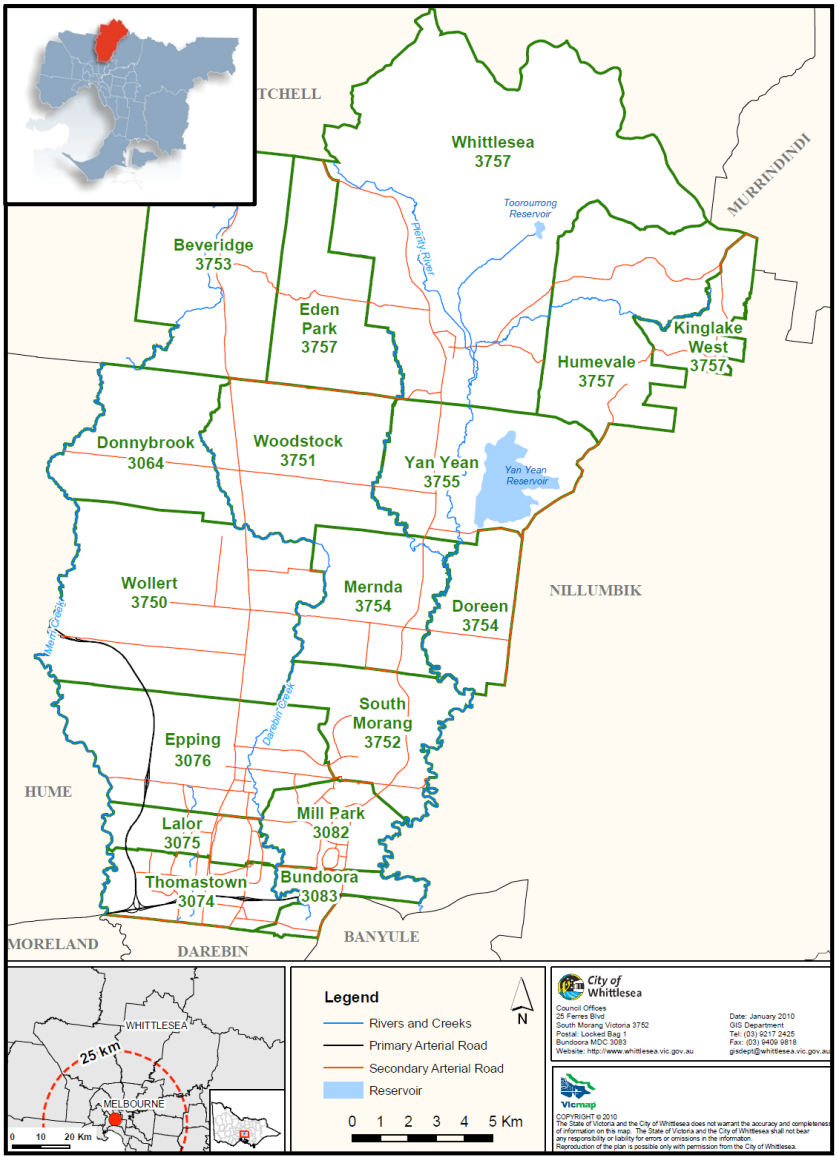


Figure 26: The Whittlesea boundary with growth areas South Morang, Meranda and Epping in the south.
Source: (www.whittlesea.vic.gov.au).

The Whittlesea growth area includes the suburbs of South Morang, Mernda and Epping illustrated in Figure 26 above. With the guidance from the DPCD's 'Growth Area Plan' (DPCD 2005), Whittlesea will provide enough land for the expected 40,000 – 65,000 additional people and accompanying 20,000 – 32,000 new homes in the area. Development of the growth areas in Whittlesea, and also other fringe growth areas, will be facilitated by the Growth Areas Authority. This is an independent statutory body that will "create greater certainty, faster decisions and better coordination for all parties involved in planning and development of Melbourne's growth areas", effectively streamlining the development application process (www.gaa.vic.gov.au). Aurora is a development located in north Epping that will eventually accommodate approximately 25,000 people and 8,500 medium to low density homes and help meet the expected housing demand. Urban development in Whittlesea is shaped by the Planning and Environment Act 1987 (PEA) which requires municipalities to produce

'Planning Schemes'. The 'Whittlesea Planning Scheme', like other municipalities', sets out a state and local planning policy framework, and zone objectives. Development also must consider objectives outlined in the DPCD's planning documents 'Melbourne @ 5 million', 'Melbourne 2030', Delivering Melbourne's Newest Greenest Communities' and 'Planning for all of Melbourne's Growth Areas'. These documents outline various policy initiatives and strategic approaches to development in Melbourne and on the fringes. They consider urban consolidation and the retaining of the UGB as a long-term approach to sustainable greenfield development in Melbourne.

Planning Aurora

During an investigation stage, the land area of Aurora was deemed unsuitable for development by the City of Whittlesea (COW), the local council, due to its inability to be serviced in terms of sewerage as a result of infrastructure capacity and cost issues. Additionally, there was reluctance by the COW to allow multiple developers to develop the area as it was thought that a single developer would produce a more consistent overall built outcome, as was explained by Rhys Loughran a Senior Strategic Planner at the COW (pers. comm., August 25, 2010). Subsequently, VicUrban, Victorian State Government's urban development agency, bought all the land in the area and became the sole developer. At the time of the researcher's fieldtrip, Aurora had six stages of urban development completed with residents living there. Other stages were under construction or being sold through VicUrban's on-site showroom. It is expected to accommodate 8,000 homes and approximately 25,000 people. The greenfield land that Aurora is situated was originally zoned for farming purposes and before development could begin the area required a 'Planning Scheme Amendment' to the 'Whittlesea Planning Scheme'.

Planning Scheme Amendment

The growth area of Aurora was originally formally classified as a 'Farming zone' (FZ) which served to provide land for agricultural activities and encourage the retention of productive agricultural land (COW 2011). As well as this, the zone ensured that non-agricultural activities did not adversely affect the use of land for agriculture and aimed to protect and enhance the natural resources and biodiversity in the area (COW 2011).

Consequently a 'Planning Scheme Amendment' (New Zealand's equivalent to a Private Plan Change) to the Whittlesea Planning Scheme (District Plan equivalent) was required under section 17 of the PEA to allow residential development in this area. Upon purchasing the fragmented lots that made up Aurora in 2003, VicUrban requested the COW to formulate a Planning Scheme Amendment to rezone the land to enable residential development: Amendment C41. The area of land is 592ha in size located within the UGB. Amendment C41 was formulated to rezone this area of land from a 'Rural zone' to a 'Comprehensive Development Zone' (CDZ). The purpose of this zone is to "provide for a range of uses and development of land in accordance with a comprehensive development plan" (COW 2011). Amendment C41 introduced such a plan under Schedule 4 to the CDZ, known as CDZ4. This relates specifically to the Aurora site. The underlying purpose of CDZ4 is to "pursue a more sustainable form of greenfield development based on traditional neighbourhood design

principles" through the implementation of "a high standard of contemporary architectural and urban design" approach that will "protect, retain and enhance the natural and cultural features of the land" resulting in a "positive sense of place" (quotes from COW 2011). Accompanying the written context of this zone, a comprehensive development plan map (required under a CDZ) known as the 'Aurora Comprehensive Development Plan' (ACDP) was incorporated into the C41 amendment to guide development activities. It is shown in Figure 27 below and show similarities to the 'Kirimoko Block Structure Plan' (Figure 18) which was incorporated into the QLD plan. It illustrates the following features: three possible community education centres, conservation areas, main street corridors, a public transport corridor and four 'activity centres'. These incorporate employment, commercial, retail, housing and community facilities and services for local convenience.

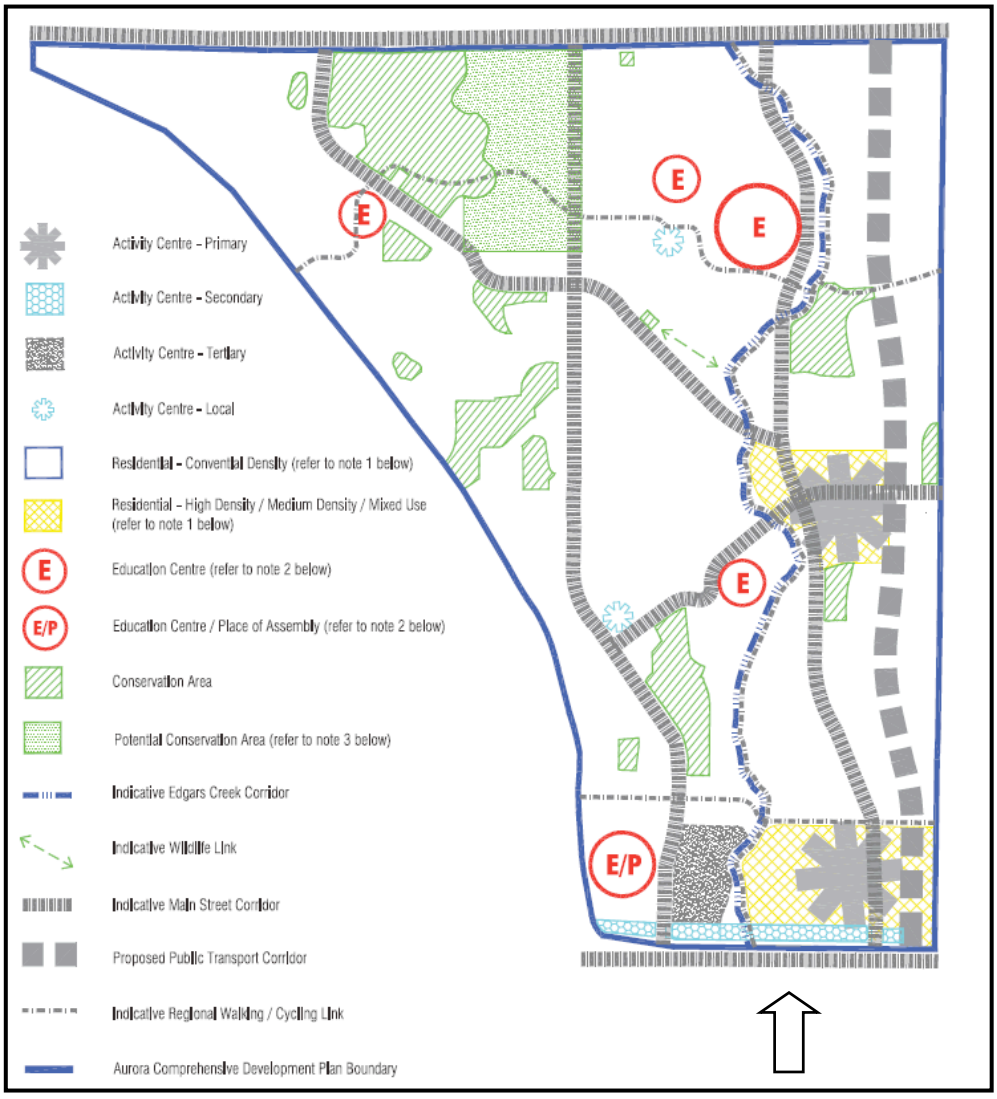


Figure 27: Aurora Comprehensive Development Plan. Source, (VicUrban 2007: p8)

To ensure the pursuance of CDZ4 and the ACDP objectives, a series of provisions under four separate 'overlays' were introduced for inclusion into the Whittlesea Planning Scheme through amendment C41. These were a Vegetation Protection Overlay (VPO2), a Design and Development

Overlay (DDO2), a Floodway Overlay (RFO) and a Development Plan Overlay (DPO23). Firstly, the VPO2 serves to protect, enhance and maintain the diversity of vegetation types and ecological integrity of indigenous vegetation in the Aurora area during its transition from rural to urban (COW 2011). As well as this, it will allow for faunal movement through the Aurora community by preserving, enhancing and maintaining natural habitat links (COW 2011). A study was conducted by the COW to identify areas of ecological significance, such as Redgum woodlands and the Growling Frog habitat. Such areas are protected under this overlay and become part of the green-space network to add amenity for residents.

Secondly, the DDO2 refers to noise attenuation measures of the future alignment of the Hume Freeway and any road or building works within Aurora. The purpose of DDO2 is "to ensure that the development of land near the future alignment of the Hume Freeway between the Metropolitan Ring Road and Mount Ridley Road is undertaken with appropriate noise attenuation measures to minimise the impact of traffic noise on noise sensitive activities" (COW 2011). Thirdly, the RFO identifies waterways, major flood paths, drainage depressions and hazard areas which have the greatest risk and frequency of becoming flooded (COW 2011). This includes Edgars Creek which traverses through the middle of Aurora. The purpose of this overlay is "to ensure that any development maintains the free passage and temporary storage of floodwater, minimises flood damage and is compatible with flood hazard, local drainage conditions and the minimisation of soil erosion, sedimentation and silting", as well as protecting "water quality and waterways as natural resources" (COW 2011). These water networks are collocated with conservation areas and/or green-spaces indentified under the VPO2 overlay.

Lastly, Amendment C41 introduced DPO23 that was intended "to identify areas which require the form and conditions of future use and development to be shown on a development plan before a permit can be granted to use or develop the land" (COW 2011). Compared to the ACDP, the Development Plan (DP) is a more detailed profile of the green, water and roading networks, as well as providing specific detail on subdivision design and urban character layout, housing locations, open space, community services, infrastructure requirements and development contributions. The DP has to be in accordance with the aims of the comprehensive development plan and the ACDP. Following that it then becomes part of or the individual 'Precinct Structure Plan', which is a master-plan of a whole community. In the case of Aurora, VicUrban prepared a DP for Aurora – the Aurora Development Plan (ADP).

Aurora Development Plan

It is important to note that the ADP (VicUrban 2007) is a part of the C41 Planning Scheme Amendment and is being explained here to illustrate its significance not only in the amendment process but more so to the built outcome of the development. The ADP is a 77 page document that begins with site characteristics of Whittlesea and Epping North, followed by an explanation of relevant 'Planning Policy and Statutory Controls' that it is in accordance with (upon being granted new zoning). The most relevant documents and policy frameworks include: the State Planning Policy Framework,

Melbourne 2030, Municipal Strategic Statement, Local Planning Policies and the ACDP. From these frameworks there are a number of policies and objectives relevant for Aurora, too many to list here, but they centre on sustainable urban design, protection of natural resources, providing services and infrastructure, and creating employment opportunities (VicUrban 2007).

VicUrban's (2007) ADP and accompanying 'master-plan', which is shown in Figure 28 below, outlines the three dwelling densities in the Aurora development: low, medium and high. The low density areas will have 14 lots/ha, the medium density areas will have 20 lots/ha, and the high density areas will have 27 lots/ha, creating an overall dwelling density of 19/ha. VicUrban (2007: p28) suggest that this is "significantly higher than 'conventional' subdivisions in the outer areas of Melbourne", indicating their 'best practice' approach through 'breaking the mould'. The lot sizes throughout Aurora also vary with the majority being 300-500m², the largest being 500-1000m², and high density lots being 180-300m². In addition, VicUrban (2007) explain that all lot sizes and orientations enable solar access which achieves Aurora's required six-star energy rating for all houses. To achieve this, VicUrban (2007) have orientated lots for detached dwellings to the east-west, and semi-detached and terrace housing lots are orientated to the north-west. Integrated with these dwelling density areas are commercial/mixed-use areas or 'activity zones' and education centres (VicUrban 2007). These are buffered by high density mixed-use areas and medium density housing comprising low-rise apartments, office spaces, and commercial and retail facilities (VicUrban 2007).

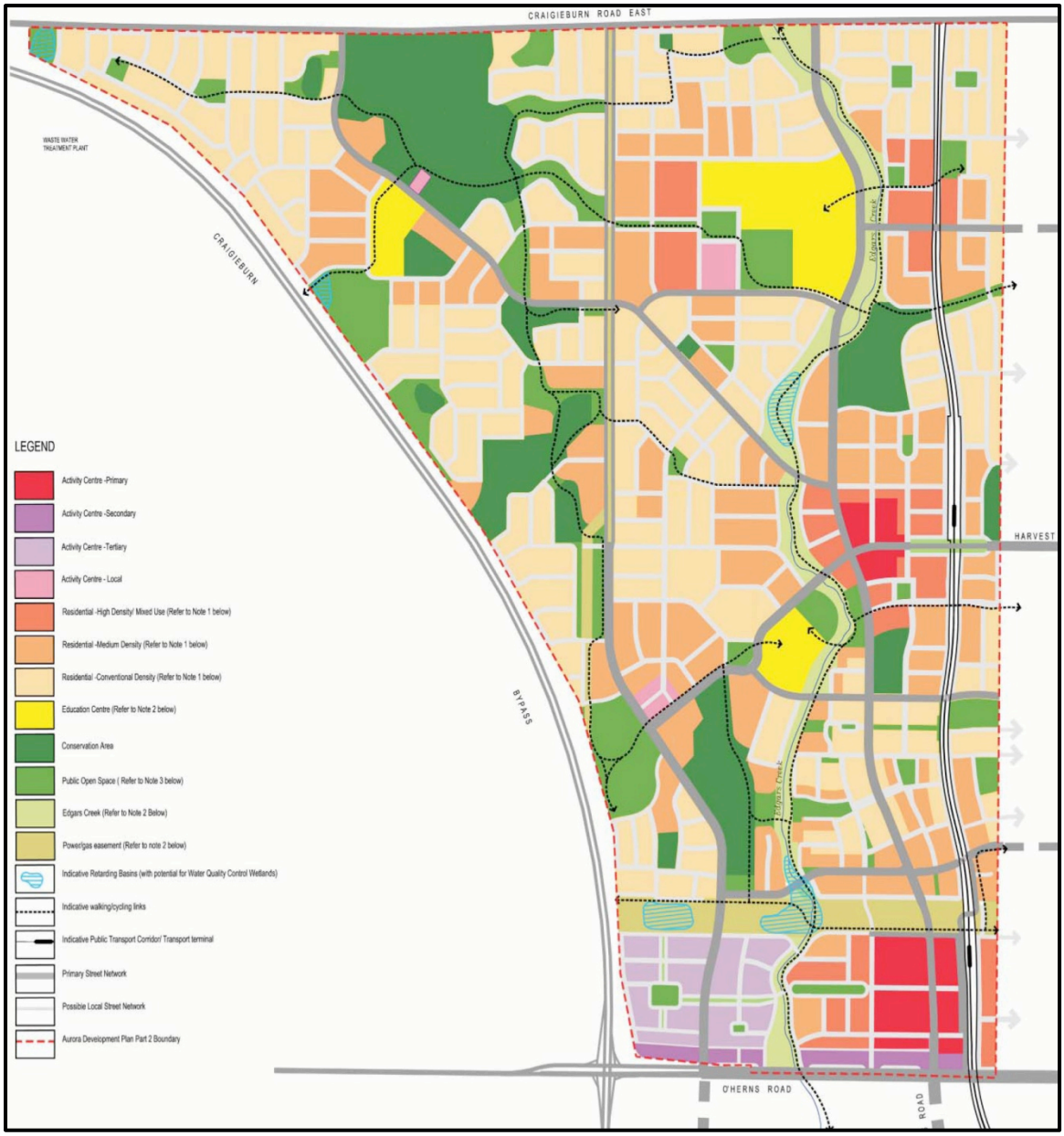


Figure 28: Aurora master-plan as outlined in the Aurora Development Plan. Source: (VicUrban 2007: p29).

VicUrban (2007) also indicated through the ADP that a public transport rail linkage has been designed to run through the eastern boundary of Aurora, illustrated in Figure 28 above as 'public transport corridor'. This connects internal activity zones and high density areas, as well as providing connectivity to Epping Plaza (local shopping mall), the Northern Hospital and the Melbourne CBD to the south (not shown on map). In addition, a "highly inter-connected street network with strong accessibility" to internal activity zones and public transport stations is supported by a bus network and an off-street cycle and pedestrian network (VicUrban 2007). These networks are illustrated below in Figure 29 and Figure 30 respectively. These public and passive transport networks also provide external linkages to existing urban areas and facilities.

Figure 29: Aurora bus routes (green) linking internal areas and connecting with existing external urban areas.
Source: (VicUrban 2007: p54)

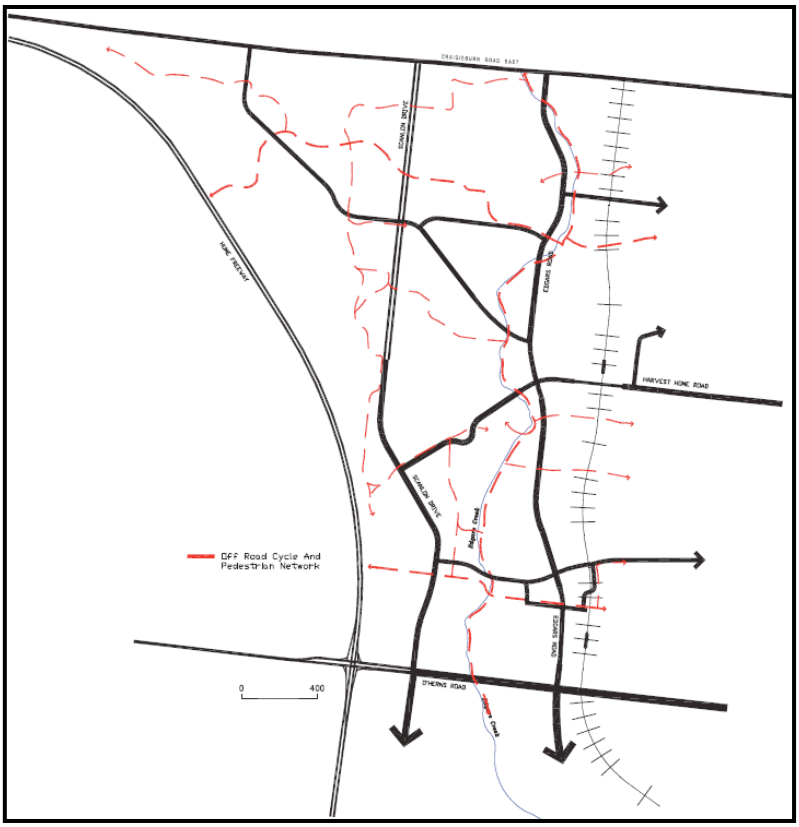


Figure 30: Aurora's off-street cycling and pedestrian network (red) with internal and external links.

Source: (VicUrban 2007: p65).

VicUrban (2007) also outlined that the green-space network is collocated with the active transport network and the storm-water network. Instead of providing a detailed description of the storm-water drainage system of Aurora, VicUrban (2007) indicated that the storm-water network follows a DWSUD approach to treat storm-water runoff and will continual evolve as new techniques and designs become available. The drainage system will be the priority of Melbourne Water Corporation (MWC), a Victorian State owned company, which is also responsible for supplying potable water to Aurora. Adding to the DWSUD, VicUrban (2007) also incorporated a recycled water system into its design. This is the responsibility of Yarra Valley Water (YVW), a state funded regulator which deals with the provision of water and treatment of sewage for the northern parts of Melbourne. The recycled water system at Aurora utilises 'grey-water', which is water generated from domestic activities, such as, dishwashing, laundry or bathing, and in Aurora's case sewage. It is transported from the home to a local treatment facility, shown in Figure 31 below, which cleanses the water to a potable standard. The water is then redistributed to households through a 'third pipe' system where residents can then use the recycled water for toilet flushing, home gardening or washing their car, additionally the COW use it for open space irrigation.

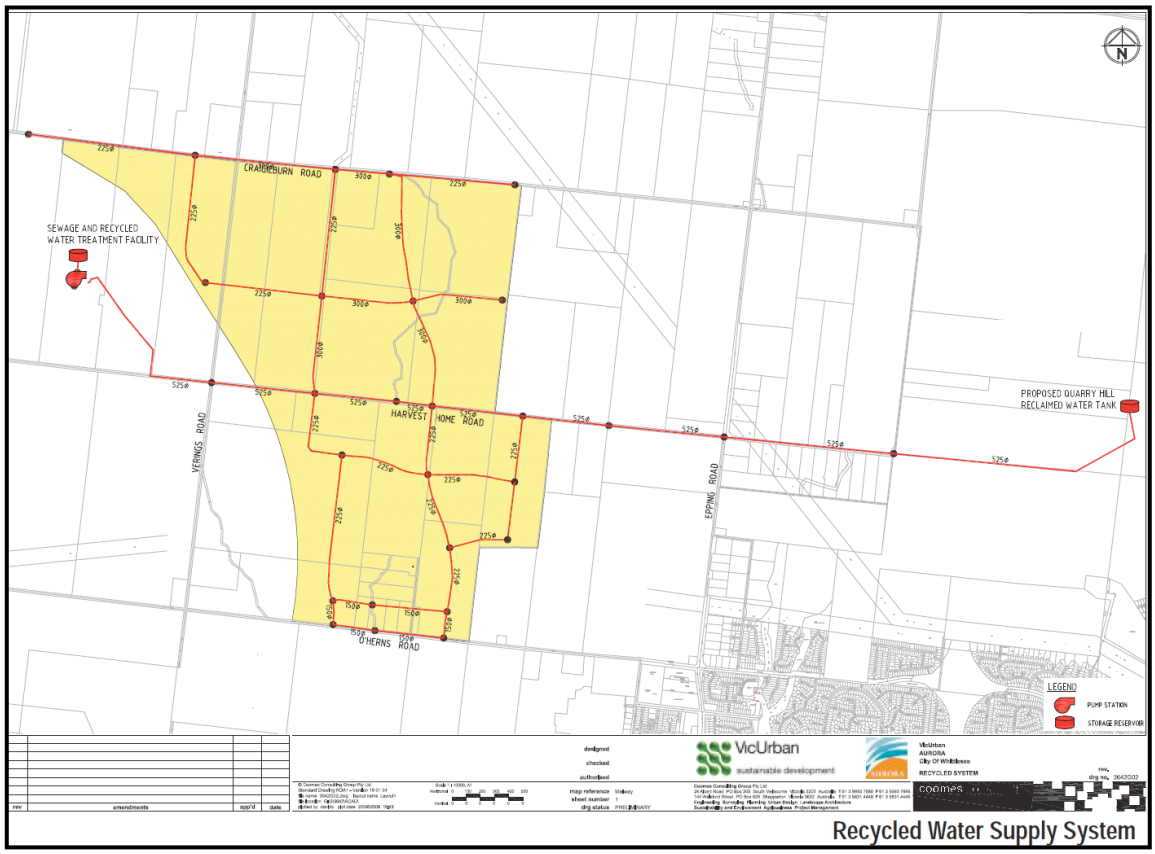


Figure 31:The location of Aurora's grey-water treatment facility and pipe system. Potable water is conveyed into Aurora from the water tank on the right and once used by residents is transported to the treatment facility on the left which is then redistributed throughout the community. Source: (VicUrban 2007: p67).

Planning/subdivision permit

The ADP outlined above and the C41 amendment has become an operative part of the Whittlesea Planning Scheme. The researcher was unable to gather specific information regarding the Planning Scheme Amendment process for Aurora, i.e. issues raised by affected stakeholders were not attained. Although information about the amendment approval process in general was gained. R. Loughran (pers. comm., August 25, 2010) explained in a personal interview that once an amendment and accompanying Development Plan is prepared and submitted to the relevant authority, it proceeds through an 'Exhibition Process' (public notification) where the public can make submissions for or against the development. Following this is a 'Planning Panel Process' formed by members of the local authority and discuss any issues regarding the development. If there are issues that cannot be resolved the State Government appoints an 'Independent Planning Panel' that is required to make decisions and recommendations on unresolved issues between developers, council representatives or submitters. Once the amendment and/or Development Plan are formulated to the satisfaction of the responsible authority, it is submitted to the Victorian State Minister of Planning for approval. Generally, any construction of a single building or subdivision will need to apply for a building permit (single dwelling) or a subdivision/planning permit (multiple dwellings). In the greenfield growth areas, if permits are in accordance with the Development Plan, such the ADP, they are exempt from notice requirements, decision requirements and review rights.

The Aurora development followed this process and the first phases of construction were carried out in 2007. The construction of houses in Aurora is undertaken by private companies who prepare subdivision plans in accordance with the ADP. To ensure these companies follow the long-term vision for Aurora, additional design controls have been specified by VicUrban which will affect each lot for all stages of development. Compliance with design controls is required as a condition of the contract of sale for each lot and does not require any consent or control from COW. Such design controls include: building design, fencing, energy efficiency rating, building materials and landscape design. The potential purchaser can choose a dwelling type from a suite of designs provided by the construction company. These designs have been formulated over a three year period prior to 2007 between VicUrban, architects and construction companies. This ensures that each dwelling will be suited to individual lots and be designed to enable the six-star energy efficient rating which incorporates passive and active solar design, and recycled water systems.

Actor Insights

VicUrban values and Aurora

VicUrban's website declares that their involvement in urban development will create more livable communities with a focus on compact, sustainable and affordable living to respond to population growth. Aurora is a community that has been touted as being a flagship development promoting best practice in urban and community design and development through VicUrban's website. This is consistent with their proclaimed values and functions under the Victorian Urban Development Act 2003 outlined in Chapter Three.

However, in an interview with a recently displaced Development Manager from VicUrban, Simon Magri, it emerged that Aurora had been a challenging project and, from this respondent's perspective, somewhat of a failure. Going on to explain that because Aurora was a government funded project and put on a pedestal as the 'greenest community in Victoria' meant that various people (political and commercial) were putting in their 'ten cents'. S. Magri (pers. comm., August 27, 2010) suggested that this resulted in inexperienced consultants not anticipating design and development problems and potentially degrading VicUrban's relationship with the COW. He insisted that Aurora's 'failure' was due to various changes in the Development Manager role. This resulted in each manager applying different development approaches which tended to stray from the original vision of the ADP. An interview with R. Loughran underlined these comments:

> *"A lot of people that have originally worked on the project have moved on which has made it really difficult. They have had about six development managers in the time that I have worked on the project which has made it really difficult because you can't get any continuity in terms of where the project is heading. VicUrban are quite pigheaded, they do what they want to do, not what we want to do" (R. Loughran, pers. comm., August 25, 2010).*

Frank Hanson, COW Urban Designer, also highlighted the change in consultants and development managers as an indication that VicUrban has lost its vision for Aurora:

> *"a lot of consultants have changed but it was the project manager and the change in leadership in VicUrban that I think meant that the thing kind of lost its way a little bit" (F. Hanson, pers. comm., August 25, 2010).*

Paul Mitchell (pers. comm., August 26, 2010), COW Development Engineer, also touched on this subject of 'silo thinking', explaining that the changes in personnel at VicUrban have produced a variety of marketing approaches to selling lots and subsequently a loss in sales to neighbouring 'standard' subdivisions. He went on to explain that the COW has developments by many of Australia's major development companies, such as Delphin, Australand and Jennings, who all have varying degrees of sustainability built into their projects. However, they promote their housing products, or 'lifestyle' packages, rather than the sustainability measures. S. Magri seemed to be in line with this thought explaining:

> *"it is important not to sell the environmental benefits but rather the amenity benefits, you have to convince the market that they are better off" (S. Magri, pers. comm., August 27, 2010).*

This comment identifies amenity benefits as an important feature for home purchasers and provides insight to the marketing mindset of developers. This also confirms P. Mitchell's feelings that VicUrban are heading down the same track of commercialisation as other developers, even though the S. Magri suggests that they are not. Mitchell (2010) explained that:

> *"VIcUrban used to be the flagship but they are becoming more and more commercialised, so they're losing their credibility in my opinion" (P. Mitchell, pers. comm., August 26, 2010)..*

R. Loughran also pointed out that VicUrban is beginning to shift away from developing greenfield areas because of the slow sales of allotments in Aurora. This is evident on VicUrban's website where

it declares they will be focussing on houses in established urban areas particularly along main transport routes, in activity centres, inner Melbourne and in large regional centres, i.e. partly in-line with the objectives of 'Melbourne @5 million'. This suggests that Melbourne residents either prefer homes located in the inner suburbs of Melbourne or that potential home purchasers are not drawn to the smaller lot sizes provided at Aurora. The evidence provided by the respondents suggests that the values presented on VicUrban's website and the ones embedded in the Victorian Urban Development Authority Act 2003 are possibly being compromised. This was indicated by R. Loughran who explained that:

> *"The whole point of Aurora was to show developers that it could be done so that they could pick up on it and we're not seeing any of them picking up on it, they're increasing their density which is one good thing but they are not picking up on the water sensitive urban design stuff" (R. Loughran, pers. comm., August 25, 2010).*

This does not necessarily mean that VicUrban's 'best practice' approach has failed at Aurora, rather their 'trial and error' approach will provide important information regarding the design and implementation of DWSUD.

Water management designs and concepts

Aurora's storm-water drainage system is based on the Edgars Creek Drainage Strategy, in which Edgars Creek will form a significant part of the drainage system and will be enhanced by DWSUD principles as outlined by Melbourne Water Corporation (MWC). The DWSUD focuses on the integration of urban planning and development with the management, protection and conservation of the water cycle through a series of principles that include: protecting and enhancing natural water systems within urban areas; integrating natural storm-water drainage systems into the landscape to maximising the visual and recreational amenities of the area; improving the quality of water draining from urban areas into the receiving environment; reducing urban runoff and peak flows through local detention methods and reducing impervious surfaces; and minimising downstream drainage infrastructure to reduce development costs and add value to properties through enhancing natural features such as rivers, creeks and wetlands (wsud.melbournewater.com.au). Other than retention basins and Edgars Creek, the conveyance system for storm-water and peak flows to these areas has not been designed or clearly defined prior to development and is rather a work in progress under continual review and refinement (VicUrban 2007). P. Mitchell was involved in an evaluation process prior to the formation of the ADP which consisted of a 'Peer Review Committee' formed by VicUrban. He was the COW representative along with various experts from around Australia to evaluate best practice approaches in DWSUD and water reuse (P. Mitchell, pers. comm., August 26, 2010).

In regards to DWSUD, P. Mitchell (pers. comm., August 26, 2010) explained that the evaluation process led to five possible water conveyance techniques. The first option uses 'streetscape bio-swales' which are bio-retention systems located at the base of each swale and provide treatment of storm-water through fine infiltration, extended detention and biological uptake, as well as providing a conveyance function. The second uses 'nodal streetscape rain gardens' which operate similar to streetscape bio-swales although they do not provide a conveyance function but rather act as a

vegetated ephemeral basin. P. Mitchell (pers. comm., August 26, 2010) explained that the advantage of these systems is their flexibility in terms of size, shape and location to fit with the streetscape. A third option was 'rain gardens for allotments' which are a form of bio-retention system that are designed to integrate household gardens into the storm-water network of the Aurora estate. These systems treat storm-water by percolation through a vegetated media which is collected by a subsurface drainage system for discharge into the main drainage system (P. Mitchell, pers. comm., August 26, 2010). A fourth option was 'linear creek rain gardens' which act similar to nodal rain gardens, although instead of being integrated into the built environment, these systems are integrated into public open space or the natural environment, such as along Edgars Creek. The fifth was to use 'wetlands' which would be constructed as shallow, extensively vegetated water bodies that use fine infiltration to remove pollutants from the water and are generally located at the 'end point' of the storm-water drainage system. P. Mitchell indicated that the DWSUD methods were voluntary approaches adopted by VicUrban that would add to existing wetlands in the area to show 'best practice':

> *"we could've relied on wetlands alone at the downstream end of the project and done nothing else and that would have satisfied the planning requirements...but we've gone further and said no it is much better if you distribute that process throughout the catchment, which is the way they have done it at Aurora" (P. Mitchell, pers. comm., August 26, 2010).*

However, he explained that the design of streetscape bio-swales were 'land hungry' which led to their demise and the subsequent of dominance of rain gardens at Aurora:

> *"it was difficult to support the provision of bio-swales because they were land hungry, in the end they were used for the first six stages and trialled but council decided at the end of that trial that the swales didn't allow enough room between the curb and the street and needed to be wider and flatter. There also needed to be more room for concrete works for pedestrian access and garbage bins. In the end the developer, VicUrban, said 'if we go down that track we will need another 2.5 per cent of our land to be used up and will be lost to areas available for allotments and we can't afford that'...so they have gone down the path of putting in rain gardens which are not as efficient, primarily because they don't take up as much area so you're dealing with a smaller area to treat the same size catchment" (P. Mitchell, pers. comm., August 26, 2010).*

This comment not only highlights the importance of designing an adequate DWSUD to produce best results for an urban area, but also suggests that other developers have not been picking up on DWSUD in Whittlesea due to the 'land hungry' nature of swales encroaching on allotment space and the added costs through complex design and implementation which reduces revenue for the developer. In addition, it also provides further evidence to support P .Mitchell's (pers. comm., August 26, 2010) claim that VicUrban are becoming more commercialised through a cost driven mindset rather than providing good examples of 'best practice'. Through observational research conducted by the researcher it was evident that there were maintenance issues for the bio-swales already in place in front of houses between the roadside and property line. They were overgrown and did not add to the 'amenity' of the area. This observation was put to P. Mitchell. He explained that the council does not take any responsibility for maintaining swales between the curb and the footpath and that the residents do not know how to do it due to their different dimensions than a 'standard' grass strip on

the roadside (P. Mitchell, pers. comm., August 26, 2010). When asked why COW does not take responsibility for the maintenance of swales, P. Mitchell replied:

> *"It is just an economic thing. Whilst it is a public road council just refuses to do anything to the grass, it will maintain the concrete footpath and pavement and the drainage but anything that is in front of the house lot is the responsibility of the home owner, including the concrete driveway between the curbing and the road. It's a bit like services, the services authority in Australia is responsible for the mains down the street but once you tap the main the service between the main and the property is the responsibility of the owner" (P. Mitchell, pers. comm., August 26, 2010).*

This presents another hurdle for developers when deciding whether to incorporate swales into their DWSUD approach as many potential buyers may be put off buying a home in an area that has difficult added amenities to maintain. It also indicates that the placement of swales in the urban environment is an important factor to consider.

In addition to trialling DWSUD approaches, Aurora will be one the first residential developments to incorporate water reuse systems. It is expected that households will use one third less potable water than others in Melbourne, with estimates that the water reuse system could amount to saving the equivalent of 400 Olympic-size swimming pools of potable water a year (P. Mitchell, pers. comm., August 26, 2010). P. Mitchell (pers. comm., August 26, 2010) explained that during his earlier involvement in the evaluation process for water initiatives, a consensus was formed among the committee that individual rain water tanks was the most desirable option for potable water, but neither the Victorian Government Health Department or Yarra Valley Water, the local water supply retailer, would accept responsibility for supplying that water on a community basis to provide a regulatory requirement:

> *"the preference would have been that everybody was actually required to have a certain size tank and required to install capture and cleanser systems, first flush devices on their gutters, and ultra-violet purification between the tank and the kitchen tap...but none of that at the end of the day could be regulated at a government level because there was nobody prepared to take on responsibility even though we had experts from South Australia that have much higher reliance on rain water tanks" (P. Mitchell, pers. comm., August 26, 2010).*

This indicates reluctance from governmental authorities to implement untried sustainable water management initiatives. Council respondent (pers. comm., August 26, 2010), COW Sustainability and Policy Projects and R. Loughran (pers. comm., August 25, 2010) in separate interviews explained that the original rationale for recycling grey-water and sewage was due to the lack of sewage disposal infrastructure. As result Aurora has two forms of water supply: potable water from Yarra Valley Water and treated water through a 'third pipe' system from a treatment facility. The third pipe system utilises recycled grey-water from households showers, toilets, kitchen sinks and washing machines that sent to a treatment facility 3kms from the Aurora community. Grey-water is then treated to 'A Class' recycled water, complying with standards set by Victorian Department of Health Services and the Australian Environmental Protection Agency, and is conveyed back to homes through a separate 'third pipe' system which can be used for toilet flushing, watering the garden and washing the car, as well as being used for irrigation of public open space and fire hydrants. Aurora's water efficient homes

are expected to create savings of $144 per year and $1,440 every 10 years for each individual household in Aurora.

Energy efficient designs and concepts

As well as recycled water, a six-star energy efficient rating design for every home is one of Aurora's dominant selling points, and an example of best practice and a resilient urban feature. F. Hanson (pers. comm., August 25, 2010) explained that VicUrban and the various housing construction companies had made agreements to a variety of design controls for the construction of housing in Aurora, which include energy efficient design. The agreement document itself could not be acquired but conditions are clearly understood through Aurora pamphlets and newsletters, and actor responses. It was outlined in the ADP and actor interview responses from P. Mitchell, F Hanson, Council respondent and R. Loughran, that Aurora homes will achieve six-star energy ratings through lot and house orientation to the sun, improved insulation and draft proofing, and better ventilation through cooling and heating units accompanied with a five-star ducted heating system. A pamphlet produced by VicUrban outlines the potential savings for households in Aurora from energy efficient approaches. These results are shown in Table 9. The first three items are required energy efficient measures that are part of a 'condition of sale' outlined earlier in this chapter, whilst the latter three are not required but encouraged.

Table 9: the expected savings for energy efficient homes in Aurora.

Potential Savings	1 year	10 years
Solar hot water system	$193	$1,930
Five-star energy efficient ducted heating system (running costs)	$140	$1,400
Energy efficient lighting	$93	$930
Energy efficient cooling system (not a standard inclusion)	$1,008	$10,080
Five-star energy efficient laundry appliances (not standard inclusion)	$95	$950
Five-star energy efficient kitchen appliances (not standard inclusion)	$45	$450
Potential total savings	$1,574	$15,740

If potential consumers choose to have only the required energy efficient measures designed into their home, the total expected savings would be $426 annually and $4,260 every ten years. The six-star energy efficient ratings on all homes and inclusion of passive and active solar design is a good example of VicUrban's leadership in 'best practice', which is evident through the incorporation of such designs by other leading developers in the region, as explained by F. Hanson:

> *"I mean Delphin Development wouldn't have been talking 8 star energy if VicUrban hadn't been pushing this whole concept and Burbank homes really promotes the fact that they do 5,6 and 7 star and they were like what can we do to make this happen?" (F. Hanson, pers. comm., August 25, 2010)*

Even though this comment also indicates a positive marketability for star rated homes, the COW respondent highlighted a problem in the marketing process:

> *We get developers saying they are getting sales but then we get some that say they aren't and then we get people's comments saying the sales team or sales assistants didn't know anything about sustainability, they're just trying to sell the home" (Council respondent, pers. comm., August 26, 2010).*

This comment is consistent with previous ones made by P. Mitchell and R. Loughran whereby developers and housing construction companies are selling the product or 'lifestyle' rather than the environmental benefits. More importantly it provides evidence to support a wide consensus that 'sustainability' is a 'buzzword' and many people using this term have a lack of knowledge and understanding the true importance of sustainable urban development or urban resilience. In addition, F. Hanson (pers. comm., August 25, 2010) highlighted the lack of knowledge and a need for behavioural change from consumers whereby they do not understand how to use their 'green' home efficiently:

> *"I think people need to have a home owner's manual to make sure they know how to use their house properly because they have all these energy efficient ventilation system and so on and if you have windows open it won't work as efficiently, also its people's habits too, what's the point in having energy efficient homes if people are still driving to work everyday and they are not recycling properly" (F. Hanson, pers. comm., August 25, 2010).*

He also outlined various criticism of star rated homes regarding the orientation of homes, this comment was supported by the Council respondent in a separate interview who explained:

> *You can build a five-star home and even a six-six star home and not take any advantage of winter sun, you know you'll have some shading to achieve your five-star rating but they don't necessarily have to orientate your house. So there are a lot of new homes in the area with five-star ratings getting built with their living areas facing the south cause it achieves a five-star because the walls and roofs are insulated and windows are double glazed, but that same five-star home may have performed better if it was orientated the right way" (Council respondent, pers. comm., August 26, 2010).*

These comments were made in relation to homes outside Aurora, although they indicate inconsistencies between the building and planning regulations in Victoria. Coupled with this, different developers tend to take different housing and lot package approaches, whereby some developers may develop the land and the construct the houses, and others may develop the land and sell the lot

to a consumer who then has to consult a housing construction company. VicUrban, although assisted with the design of houses for Aurora through 'conditions of sale', have no part in the physical construction of houses. These different approaches may lead to different urban outcomes which add to the question as to how sustainable urban development should be done.

Sustainable urban development in Melbourne

All urban development activities in Melbourne, and Victoria, are guided by the Planning and Environment Act 1987, the purpose of which under section 1 is to "establish a framework for planning the use, development and protection of land in Victoria in the present and long-term interests of Victorians". State wide planning documents that stem from this Act include: Melbourne 2030, Planning for Melbourne, Delivering Melbourne's Newest Communities, and A Plan for Melbourne's Growth Areas. All incorporate notions of 'sustainable urban development' that identify priorities for the planning of Melbourne's transport system, environmental sustainability, urban growth and climate change effects. These documents then influence individual municipalities' Planning Schemes which combine a State Planning Policy Framework (similar to regional policy statements in New Zealand) that applies to all municipalities of Melbourne and Local Planning Policy Framework with planning provisions that come under them. Each municipality can amend its Local Planning Policy Frameworks to include a greater depth of sustainability or sustainable urban design. This is done through amending land zones and overlays to require more sustainable urban development measures from developers. The Council respondent (pers. comm., August 26, 2010) explained the state government's only involvement in the planning system is through the State Planning Policy Statement set out by the DPCD. R. Loughran (pers. comm., August 25, 2010) also confirmed this and added that it is very easy to be in accordance with the State Planning Policy Framework and that it is basically up to the individual council to establish stronger sustainable urban development guidelines through the same process as the planning scheme amendments. The varying degrees of sustainable urban development policies written into each municipalities 'Planning Scheme' may produce inconsistencies of urban form across Melbourne.

Perceived barriers to sustainable urban development

The nature of the planning scheme in Melbourne municipalities, and wider Victoria, results in each council having different standards and zoning requirements. This can present confusion and conflicts in terminology and standards between developers and councils, but more importantly can produce a variety of urban outcomes. This provides a difficult task for planners when attempting to convince developers to incorporate sustainable urban design into their developments, and can also produce internal council problems between different council departments. R. Loughran provides an example of this in relation to Aurora:

> *"The main problem that I have as a planner is convincing everyone within council that just because it doesn't meet council standard doesn't mean we have to refuse it, we need to consider not only the cost to council but also the cost to the environment and other environmental issues. So for example, before Aurora came along we didn't have any swales or rain gardens and our engineers had never*

> *seen them before so they didn't know anything about how they worked or what the ongoing maintenance costs were going to be, so educating people within council about things like that can be difficult" (R. Loughran, pers. comm., August 25, 2010).*

This also highlights the cost consciousness of councils with regards to incorporating untested sustainable design approaches. In addition, this lack of knowledge may generate further 'silo thinking' internally and externally potentially affecting the vision for a particular development, as well as the DPCD's (2008a) vision of Melbourne becoming "one of the most liveable, attractive and prosperous areas in the world for residents, business and visitors".

Summary

Aurora incorporates six-star ratings for every home through better insulation and ventilation, and passive and active solar design. It also incorporates a grey-water reuse system and DWSUD collocated with active transport routes. Aurora also accommodates a mix of densities, activity zones and a public transport network that provides for the needs of residents. There was a perception among the respondents that VicUrban's Aurora was a failure in terms of influencing 'best practice'. This was generally talked about with regards to changing Development Manager roles, 'silo thinking' and the DWSUD approach. The problems with DWSUD highlighted by respondents were: the land hungry nature of some types of swales, their placement within urban settings, and complex design and implementation, all contributing to added costs to the developer. In addition, maintenance conflicts over swales were evident between council and residents, which at the time of the fieldtrip were unresolved. It was also identified that councils have a reluctance to incorporate untried sustainable features, such as individual water reuse systems. In regards to energy efficient design, even though there was positive market appeal for such homes it was indicated that consumers did not fully understand how to use their 'green' home, effectively making them inefficient. This could be a result of the sales consultants who sell the housing product having a lack of knowledge and understanding of energy efficiency and sustainability. Also criticisms arose over the design of star rated homes, whereby a six-star home can be achieved without passive solar design. Lastly the planning scheme framework in Melbourne allows individual councils to amend planning schemes to incorporate more sustainable urban development objectives which will lead to inconsistent urban form outcomes across Melbourne.

Chapter Eight: Towards Urban Resilience?

A paradox can be defined as something that is inconsistent with or opposed to the known facts. In terms of the urban environment a paradox exists whereby urban development continues down a cost minimisation approach resulting in low-density, car-orientated, energy-intensive urban form even though the social and environmental benefits of creating resilient residential communities through the adoption of collective sustainable urban designs and practices are well known. Fundamentally the thesis is concerned with exploring the barriers to creating resilient residential communities in order to establish pathways towards reducing cities' vulnerability to peak oil and impacts on climate change. It has investigated three new residential developments that have adopted aspects of sustainable urban design and are advocated as being modern, innovative and sustainable residential communities.

NTP's Wigram Skies has been designed by Woods Bagot to be in accordance with the CCC's greenfield management zone, Living G. It will accommodate mixed density of housing, small scale retail shops and services, and a distributed storm-water conveyance and drainage system that is collocated with road, cycle and pedestrian networks, as well as adjoining and enhancing the Heathcote River. These features provide local convenience, a diverse range of housing types and affordability options, a diverse range of transport mode options, and connectivity to internal and external urban spaces, illustrating Living G's emphasis on urban consolidation and 'sustainable development'. Crescent Investments' Kirimoko development which is being headed by John May follows a landscape-based, low-impact storm-water design approach that replicates a conservation style subdivision. This approach is regarded as a sustainable alternative to greenfield development. It accommodates cluster housing, passive and active solar design, rain water harvesting and a distributed storm-water conveyance system collocated with open space, road, pedestrian and cycle networks that provide internal and external connectivity. Although VicUrban's Aurora was perceived as a failure in terms of political leadership of sustainable urban development by interview respondents, the combination of the COW's Comprehensive Development Zone and VicUrban's ADP have produced a community with various resilient aspects, such as diversity of transport mode options (bus, train, cycle, pedestrian), energy sources, water sources and housing options, and the intra-urban and extra-urban connectivity of various places and spaces.

To explain the reluctance to incorporating sustainable urban designs and features in many new residential developments has been attributed to cost or financial constraints: i.e. the cost of sustainable infrastructure and expertise for instalment, the cost of designing complex systems and technologies, and the cost of the required maintenance for certain initiatives. However, although cost is identified as an obvious constraint to creating resilient residential developments, it is necessary to

understand the deeper interactions and relationships within urban governance configurations and the development process at these places in order to figure out how to respond to current and future urban challenges and shape new pathways towards urban resilience. This will be discussed using the three research objectives outlined in Chapter One which run through the theme of the thesis.

Identify a range of key actors involved in development process at each development site and examine the extent to which they themselves are barriers in the process of constructing sustainable communities

The urban governance configurations identified at each site that have contributed to the design outcomes of the particular development consisted of a range of actors from both the public and private sectors. Public actors included council strategic planners, policy planners, urban designers, and development engineers, and potential home purchasers. The private sector actors included developers, architects, landscape architects, environmental engineers and planning consultants. However, the case study evidence suggests that the knowledge and experience of council planners and urban designers, and the relationship between the potential home purchasers' 'lifestyle' preference and developers' risk and cost minimisation approach present significant barriers in the process of constructing sustainable residential communities. This is consistent with Bowman and Thompson (2009) who in their study on investigating the barriers to implementing conservation subdivisions explained that these actors have a dominant affect on the design and marketing of residential communities.

The knowledge and experience of each actor and their ability to communicate ideas and concepts influence the decisions made on particular sustainable urban design options for each site. However, due to the various actors involved in this process, power relations were present and 'silo-thinking' emerged as a common quandary to collaborative urban design. Internal silo-thinking between the various new development managers and consultants at VicUrban resulted in changes in their development and marketing approaches for Aurora. This meant that inexperienced consultants did not anticipate design problems of Aurora's DWSUD and conflicts occurred over design objectives between VicUrban consultants and the COW, resulting in external silo-thinking. Internal silo-thinking was also evident in all three council authorities used in this research. This was generally identified through an inconsistent interpretation of 'sustainable urban development' within and between council departments. The inconsistencies may become problematic for planners and urban designers who have a direct role in reviewing development applications potentially resulting in inconsistent planning decisions. Therefore, the experience and knowledge of council planners and urban designers can affect their ability to influence site appropriate sustainable urban design and encourage developers to pursue alternatives to status quo urban development.

In saying this, developers are not easily persuaded. They are restricted by the market and will only pursue residential designs and features that they know the market are willing to purchase and what they can achieve within the statutory framework. This ensures high returns and minimal planning costs. The cost conscious mindset of developers is influenced by a perceived psychological and market resistance to incorporating sustainable urban design into residential developments. This is

attributed to the added costs incurred by developers for certain urban design approaches and the potential home purchasers' unwillingness to pay for sustainable features, thereby discouraging developers from investing in sustainable urban design due to risk of low sales and returns.

Examine and assess the development process at three urban development sites and identify the political and institutional elements that influence the adoption of sustainable water management and energy efficient designs and concepts

The political elements that have influenced sustainable water management and energy efficient design at Wigram Skies and Kirimoko result from New Zealand's RMA. It does not specifically require such concepts and designs, rather it devolves responsibility and regulatory control to regional and territorial authorities under section 72. However, population pressures force local councils to adopt minimum urban development regulations and standards based on old planning philosophies of vehicle dependence to enable developers to supply housing demands. Hence Christchurch's and Wanaka's living zones, and associated rules and objectives, established to guide urban development practices under the CCP and the QLDC Partially Operative District Plan lack the mandates to require sustainable water management and energy efficient designs to appear in the built outcome. Rather Wigram Skies' storm-water drainage system was a product of the CCC's ICMP for the south-west of Christchurch and NTP's desire to push storm-water management. Kirimoko's water management designs were a product of John May's vision and a collaborative design approach between an environmental engineer (M. Pennington), a landscape architect (R. Kruger) and an architect (N. Lauenstien).

Aurora's water management and energy efficient designs were influenced by the PEA and the Victorian Urban Development Act 2003 - VicUrban. The PEA enacts a similar methodology for guiding urban development practices to the RMA. It sets a broad planning framework for the protection and enhancement of Victoria's natural and built landscape. The PEA bestows responsibility and regulatory control to municipal councils, where Planning Schemes are established with living zones, rules and objectives that guide urban development within the municipality. Aurora was shaped by the COW's Comprehensive Development Zone. Although it does not specifically require sustainable water management practices and energy efficient design, it broadly outlines that development within this zone must pursue a more sustainable form of greenfield development through high quality urban design approaches that seek to protect and enhance the natural and built features of the area while at the same time providing a diversity of 'lifestyle' choices, transport options, and local recreational and commercial opportunities (COW 2011). This, along with VicUrban's role to demonstrate 'best practice' and 'environmental protection', influenced the adoption of sustainable water management and energy efficient designs.

The three development sites illustrate that each developer's institutional values and visions for their residential development plays an important role in the adoption of sustainable water management and energy efficient design. Although the values held by NTP are said to be derived from traditional Ngai Tahu values which speak of guardianship and stewardship of environmental resources important for Ngai Tahu and future generations. Wigram Skies has been designed to 'western ideals' and does not

incorporate active or passive solar design to reduce energy consumption, which has been indicated in Chapter Two as an increasing concern for urban environs through its connection with climate change and peak oil vulnerability. However, it does emphasise mixed-density/mixed-use development with a sustainable storm-water drainage system. This indicates that NTP are not only minimalistic in their 'innovative' sustainable urban designs and Kaitiakitanga practices, but also that they incorporate urban design features for character and amenity benefits and therefore marketing advantages, rather than primarily for their sustainable outcomes. This was also evident in the Aurora case study whereby Simon Magri suggested that it is important for developers to sell the amenity benefits to convince the market they are better off rather than selling the environmental benefits. This suggests that VicUrban's values of demonstrating 'best practice' and 'environmental protection' are being compromised by commercialisation. John May's vision for Kirimoko was to provide leadership in urban design in Wanaka by steering away from the lowest common denominator blandness to illustrate the commercial viability of sustainable urban development. His vision cannot be faulted as the design of Kirimoko goes beyond the rules of the QLDC's Partially Operative District Plan. The longevity of his vision is protected by a suite of covenants that will be managed by future Kirimoko residents.

In regards to storm-water management initiatives, the three development sites indicate that they are increasingly incorporated into new residential development across Australasia. This is partly due to developers' willingness to incorporate such design for marketing advantages and consumers' attraction to the marketed imagined 'lifestyles'. As well as, the councils' proactive activities to developing storm-water management plans or strategies, such as the CCC's Integrated Catchment Management Plan (ICMP) and the COW's Edgars Creek Drainage Strategy.

Provide an understanding of progress in New Zealand and Australia towards sustainable urban development and illustrate whether the creation of 'resilient' residential communities can be successfully embedded into urban policy and planning strategies to reduce impacts on climate change and vulnerability to peak oil

The resource focused, plan driven and participatory nature of the New Zealand's urban development regulating device, the RMA, has produced a plethora of outdated anti-sustainable regulations and rules that sit within City Plans and engineering standards. This 'regulatory lag' produces a variety of planning hurdles and increased planning costs for developers when wishing to achieve sustainable outcomes that steer away from council regulations, thereby detracting them from pursuing sustainable urban design and forcing them to take the expedient route of compliance with anti-sustainable regulations. As well as this, the lack of emphasis on social sustainability and urban design principles, which are central tenets of a well functioning urban system, within the RMA perpetuates the paradox of sustainable urban development in New Zealand. In contrast, Victoria's PEA follows a similar development approach to New Zealand, whereby regulatory and land-use control are delegated to local councils. Although it is somewhat different from other Australian State's planning Acts, it reflects Australia's recognition of the importance of social sustainability and urban design when creating new urban communities through it's emphasis on urban and social planning. As well as this, State leadership is emphasised in each municipality's Planning Scheme which encourages comprehensive

urban development, and through the presence of the GAA and DPCD provide added support for municipal councils. However, Melbourne, and other sprawling cities throughout Australia, still exhibit similar urban challenges to New Zealand and are also faced with future urban challenges of climate change impacts and peak oil vulnerability.

The adoption of sustainable water management and energy efficient designs into new residential developments can provide further insight to New Zealand's and Australia's urban governance configurations which influence progress towards sustainable urban development. There is a clear indication that alternative storm-water drainage systems are being incorporated into new residential developments, although the RMG focus group argued that councils will often be opposed to developments with 'too much' green space due to maintenance cost, thereby discouraging developers to pursue such conveyance systems. In addition to this, the complex design and placement of a distributed storm-water conveyance systems within the urban environ were regarded problematic and should be carefully considered when implementing vegetated drainage systems. These are ongoing issues at Aurora, and were raised as concerns by the QLDC when reviewing Kirimoko's development plans.

The implementation of water reuse and rainwater harvesting systems carried out by VicUrban and John May were voluntary approaches that provide a diverse range of water sources for the community. Although it is widely practised in some states of Australia, it is rarely practised in New Zealand. The main reason for their exclusion at Wigram Skies, and possibly wider New Zealand, from the CCC's perspective was due to health concerns and the assumption that residents would not maintain the systems. However, this perspective was based on research conducted before the September 2010, February and June 2011 earthquake events. Given these events and their prolonged presence the perspective and willingness of council and residents to incorporate and maintain these systems may have changed. Rain-water harvesting or distributed treatment facilities for grey-water may provide a resilient answer to Christchurch's water disturbances during earthquake events, which generally cuts off water availability to large residential areas for days or weeks.

In regards to energy efficient designs, their adoption in New Zealand is minimal, although Aurora indicates a growing consumer preference for such designs and technologies in Melbourne. Aurora features both passive and active solar design contributing to six star energy rated homes, and Kirimoko includes passive solar design supported by a covenant that requires homes to be 'solar ready'. These two developments illustrate their resiliency through the diversity of renewable energy sources and illustrate how they can be implemented in new residential communities. Other than the required double glazing and insulation for houses in New Zealand, Wigram Skies does not include any added energy efficient design to reduce energy consumption. Again this was attributed to consumers' reluctance to pay the large front-up costs of active solar design, although this does not explain the lack of passive solar design at Wigram Skies. Alister Gardiner, Manager of the Distributed and Hydrogen Energy Team at Industrial Research Limited, a Crown Research Institute mandated to support New Zealand Industry, provided his personal opinion on distributed energy generation. He explained that the high application and transaction costs, inability to invest upfront due to uncertainty

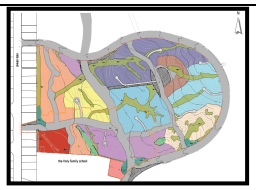
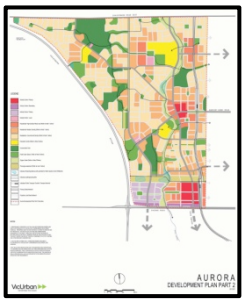
of returns, high early market installation costs and a lack of knowledge of distributed energy options for consumers are common constraints to distributed energy generation in the urban environment. In addition he explained that there is a lack of Central Government influence, and therefore local government influence, on requiring distributed generation (A. Gardiner, pers. comm., February 12, 2011).

However, to use the Christchurch example again, distributed energy not only provides an opportunity to reduce the amount of GHGs produced by centralised electricity generation plants and GHGs produced at the individual home level that contribute to climate change, but can also provide resilient urban electricity generation in times of natural disasters. Even though A. Gardiner (pers. comm., February 12, 2011) explained that the present distributed generation system (e.g. a network connected to photo voltaics) is not designed to operate on a 'stand alone' mode due to safety regulations and the cost of infrastructure to allow such operation. In a city such as Christchurch where it is predicted to experience earthquakes over the next few years disrupting electricity supply and affecting businesses raises concerns about electricity security in Christchurch. A. Gardiner (pers. comm., July 12, 2011) explained that distributed generation systems are more resilient than central electricity supply during extreme events. Although for this to work in Christchurch he explained that it will need to be designed to 'stand alone' system during extreme events. Post-earthquake perceptions on distributed energy or active solar design would more than likely have changed for many residents and businesses, and therefore maybe willing to incorporate and pay for such systems.

This evidence suggests that although the RMA and PEA may restrict sustainable outcomes through regulatory lag, the financial constraints for councils, developers and consumers play a key role in creating resilient urban communities. The wider range of resilient features in the three development sites are illustrated in Table 10 below.

Table 10: Urban project design outcomes

Urban Project	Developer vision	Water management	Energy efficient design	Other resilient features
Wigram Skies 	NTP: create a vibrant community which will set the standard for modern, innovative and convenient living in Christchurch	Distributed storm-water conveyance and drainage		Mixed-use/mixed-density Affordable housing options Collocation and connectivity of road, public transport, cycle and pedestrian routes with storm-water system and Heathcote Local convenience retail and services
Kirimoko	John May: to provide a high quality living environment that will influence leadership for new development in Wanaka and	Distributed storm-water conveyance and drainage network Rain water harvesting system for	Home are to be 'solar ready' to enable solar technologies in the future. Passive solar design	Mixed-density/cluster housing and affordable housing options Collocation and connectivity of open space, road, cycle and pedestrian routes with storm-

	encourage the community to turn away from lowest common denominator blandness	every home		water conveyance system Kirimoko Covenant which establishes a management body for the community
Aurora 	VicUrban: to create the greenest community in Victoria and to provide leadership and best practice in terms of environmental protection and urban design	Distributed storm-water conveyance and drainage system Grey-water reuse system incorporated into every home through a 'third pipe'	Six star energy efficiency rating on every home. This includes active and passive solar design	Mixed-use/mixed-density Affordable housing options Collocation and connectivity of the open space, road, public transport (train and bus), cycle and pedestrian networks with the DWSUD Local convenience retail and services

Although New Zealand and Australia share similar urban challenges, Table 10 illustrates that Australia are making more progressive steps towards sustainable urban development compared to New Zealand. However, both countries would benefit from financial incentives and greater political leadership to ensure resilient residential communities become embedded into urban policy and planning strategies. Financial incentives include the reduction in development contributions when incorporating resilient elements into new residential developments, or streamlining the consent application process through fast tracking consents that are in accordance with council plans, policies, objectives and a comprehensive development plan that is based on urban resilience principles. These approaches have the potential to reduce the cost of development to the developer which will flow onto the consumer. Politically, the higher level governments ought to establish a statutory urban design framework based on elements of 'urban resilience' in which developers and planning professionals can measure the resilience of proposed residential developments to provide a consistent interpretation of sustainable urban development. Additionally, New Zealand would benefit from establishing an energy efficient rating system under the Building Act 2002, similar to Australia. It would require new homes to incorporate active and passive solar design, or at least the necessary infrastructure for homes to be 'solar ready'. An energy efficient rating system can be supported by a 'feed-in tariff' scheme for distributed energy generation similar the UK's system. This approach encourages the 'sixth wave of industrialism' (the production and investment of renewable energy generation at the household or community level) and operates under a policy mechanism which provides a long-term contract that subsidises renewable energy investment and gives producers the opportunity to sell surplus electricity back to power retailers (A. Gardiner, pers. comm., July 12, 2011).

This thesis has explored the paradox that urban development continues to follow a 'business as usual' path, even though the advantages of 'breaking the mould' though the adoption of sustainable urban designs and concepts are well known. The connected social actors that comprise urban governance configurations in New Zealand and Australia shape residential developments through

their actions, values and visions, as well as their knowledge and awareness of the current and future urban challenges. Further qualitative research conducted on urban governance configurations, urban planning frameworks and consumer 'lifestyle' preferences in New Zealand and Australian cities, as well as additional quantitative evidence on the economic benefits of sustainable urban design for all stakeholders will ensure progress towards urban resilience.

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